Sect 27

SCIENCE

THE LIBRARY OF CONGRESS
SERIAL RECORD
SEP 24 1951

SEPTEMBER 21, 1951

VOLUME 114 NUMBER 2960

Contents

Radiocarbon Dates, II: *W. F. Libby* ____ 291

Technical Papers

Some Properties of an Ascorbic Acid Oxidation Inhibitor in Vegetables: *Barbara J. Branthoover* and *Margaret McGregor Hard* ____ 296

Prolongation of Clotting Time in Dormant Estivating Mammals: *Arthur Svihla, Howard R. Bowman,* and *Ruth Ritenour* ____ 298

Reversed Phase Partition Chromatography of Steroids on Silicone-treated Paper: *Theodore H. Kritchevsky* and *Arne Tiselius* ____ 299

The Alarm Reaction and the Hibernating Gland: *Paavo Suomalainen* and *Anna-Maija Herlevi* ____ 300

A Method for Dissection and Electrical Study *in Vitro* of Mammalian Central Nervous Tissue: *Donald O. Rudin* and *George Eisenman* ____ 300

Lewis Evans' Early American Notice of Isostacy: *George W. White* ____ 302

Liver Cirrhosis with Ascites, Induced in Dogs by Chronic Massive Hepatic Irradiation with Radioactive Colloidal Gold: *P. F. Hahn, Marvin A. Jackson,* and *Horace Goldie* ____ 303

Comments and Communications

J. M. Cruxent, W. J. Pitozynski, Kurt Schmidt-Nielsen, Louise Stemmle, Ludwig von Bertalanffy, George N. Wolcott, Robert Wolf, and *Frederick F. Yonkman* ____ 306

Book Reviews

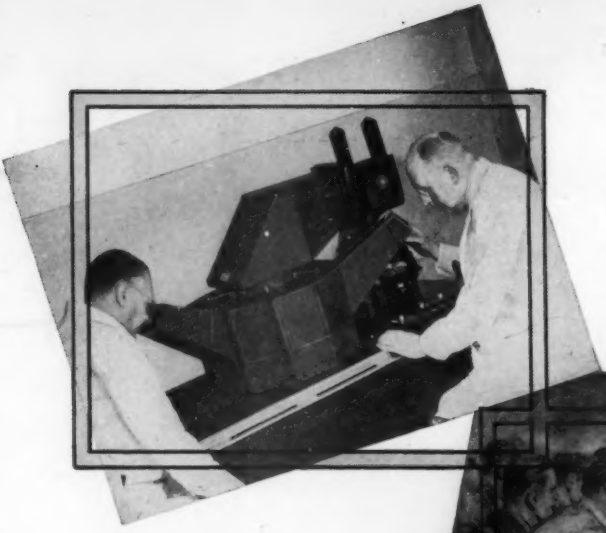
Plant Growth Substances; L'Evolution Biologique; Selected Topics in X-Ray Crystallography from the Delft X-Ray Institutes ____ 309

News and Notes ____ 311

Phosphorus Metabolism ____ 3

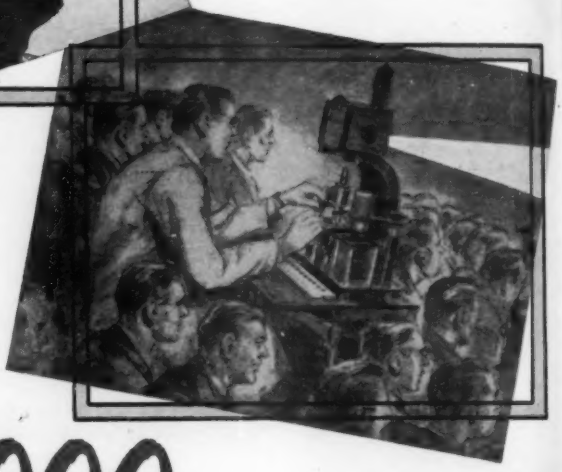
Meetings & Conferences ____ 16

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



SMALL-GROUP STUDY IN A NORMALLY LIT ROOM

The image is cast upon a screen in the dark-chamber turret at table height. Each observer (up to 10) has a separate light-excluding viewing hood. The pathologist here is discussing a slide with the surgeon; the unused hoods are easily shuttered off.

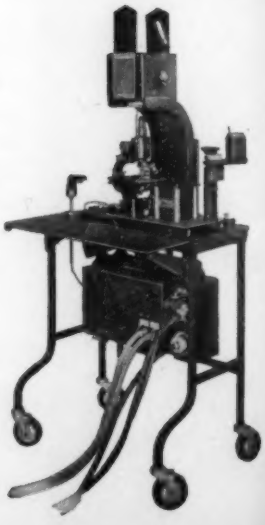


LARGE-GROUP EXHIBITION IN THE DARKENED AUDITORIUM

So intense is the Scopicon light source that images up to ten feet across can be projected. Through a system of auxiliary lenses the operator can follow a biological specimen through a progressive series of ever-closer localizations, up to ultimate demonstration under oil-immersed objectives.

2 or 10 or 1000

Quickly adaptable to viewing on any scale, the mobile Scopicon couples convenience with efficiency. Its high-pressure mercury arc is the brightest light source ever employed for microprojection. The focal spot is only 1mm square (approx.). Its pinpoint character permits flickerless projection of sharply detailed images up to ten feet across *even under oil-immersed microscope objectives*. Let us send you the brochure describing this remarkable instrument.



Scopicon

micro-projection equipment

SCOPICON, Inc. 215 E. 149 ST. NEW YORK 51

A New Book

FULTON'S DECOMPRESSION SICKNESS

This *new monograph* reviews today's knowledge of the causes, prevention and treatment of decompression sickness. It presents the practical findings of extensive research carried out during the Second World War by the National Research Council, and is intended to promote greater comfort and safety for those engaged in high-altitude flying or in work carried on under great physical pressure—diving, tunnel operations, etc.

Research physiologists should find of particular interest the sections on the symptomatology of decompression sickness; on the mechanics and the physiological effects of nitrogen bubble formation (there is a great deal on animal experimentation in this field); and on constitutional and environmental factors affecting decompression sickness. Among the new techniques described is the use of radioactive inert gases for estimating rates of gas exchange between blood and tissues and rates of nitrogen elimination through the lungs.

Edited by JOHN F. FULTON, M.D., formerly Chairman, Subcommittee on Decompression Sickness, National Research Council; formerly Sterling Professor of Physiology and Chairman of Department of Physiology, Yale University School of Medicine. Compiled under the auspices of the Subcommittee on Decompression Sickness, Committee on Aviation Medicine, Division of Medical Sciences, National Research Council. 437 pages, 6" × 9", illustrated. $8.50. *New.*

Order Form

8 9-21

W. B. SAUNDERS COMPANY **W. Washington Square Philadelphia 5**

Send me Fulton's Decompression Sickness

Price: $8.50 ☐ **Bill me** ☐ **Charge my account (if M.D.)**

Name .....

Address .....

.....

THE WELCH DENSICHRON® DENSITOMETER

UNSURPASSED STABILITY
EXCEPTIONAL LIGHT SENSITIVITY
PATENTED MAGNETIC MODULATION
NO ZERO ADJUSTMENT
CONVENIENT SMALL SIZE 5×7¼×13 IN.
LIGHT IN WEIGHT—ONLY 11½ POUNDS

No. 2150

The SPECIAL FEATURES OF THE DENSICHRON* qualify it for use in many light-measuring operations in scientific research and industrial process control. Some of the laboratory applications for which the DENSICHRON is particularly well adapted are—

PHOTOMICROGRAPHY
PHOTOFLUOROMETRY
REFLECTOMETRY
MICRODENSITOMETRY
COLORIMETRY

The DENSICHRON is supplied complete with a blue-sensitive light probe (or red if specified), five measuring apertures, a cone with ⅛ inch aperature, and metal support for the probe unit. The current consumption is 30 watts. For operation on 115 volts—60 cycle AC only—

WRITE FOR 12-PAGE BOOKLET GIVING OPERATION CURVES, RESULTS OF LABORATORY TESTS AND OTHER VALUABLE INFORMATION.

EACH $225.00

Reflection Unit Accessory with Voltage Regulated Transformer—$75.00

*Reg. U.S. Pat. Office

W. M. WELCH SCIENTIFIC COMPANY

Established 1880

1515 SEDGWICK STREET, Dept. E, - CHICAGO 10, ILLINOIS, U. S. A.

Manufacturers of Scientific Instruments and Laboratory Apparatus

Gladys M. Keener
Executive Editor

AAAS EDITORIAL BOARD
(Terms Expire June 30, 1952)

Howard A. Meyerhoff, **Chairman**
William R. Amberson Karl Lark-Horovitz
Bentley Glass Lorin J. Mullins

F. A. Moulton, Advertising Representative

Phosphorus Metabolism

ONLY now, a full twenty years since the discovery of the energy-rich phosphate bond, has the key role of phosphorus in metabolism become widely appreciated among biologists. Ten years ago, in already classic reviews, Lipmann and Kalckar stretched the nature of the phosphate cycle and the widespread generation and utilization of energy-rich phosphate bonds in organisms. However, award of the Nobel prize (1947) to C. F. and Gerty Cori for their work on the role of phosphorus in the reversible transformation of glucose to glycogen was required to quicken and extend the general interest of biologists. The subject even begins to appear in new college textbooks of general biology, although by no means in all.

Landmarks along the way began with the discovery of hexose phosphorylation (Harden and Young, 1905). Then came creatine phosphate (Fiske and Subbarow, 1929) and the work of Lohmann and Meyerhof on phosphate energy in muscle contraction (1934), the calculation that *all* the energy from the utilization of sugar goes into the energy-rich phosphate bond (Lundsgaard, 1931), and the isolation of three phosphorus-containing coenzyme systems—adenosine triphosphate (ATP), diphosphopyridine nucleotide (DPN), and diphosphothiamine. These coenzymes, especially, revealed the crucial role played by phosphorus in the transfer and release of energy through phosphorylation, oxidation-reduction, and decarboxylation. The symbols ATP and DPN are fast becoming as widely known as the symbols of chemical elements or genes.

It is particularly appropriate that this anniversary of discovery has been celebrated by a symposium on the metabolic functions of the phosphate esters. The gathering was attended by many of the leaders in the developments of the past two decades. There were about 120 participants, with The McCollum-Pratt Institute of The Johns Hopkins University, Baltimore, as host. The dates: June 18–21.

The subject is so vast that discussion was limited to the functions of phosphate in carbohydrate and protein metabolism. (The remainder will be considered in a second symposium.) The program was organized in an original and singularly effective way. Each session had as moderator a notable pioneer or leader in the field: the Coris, Green, Gunsalus, Heppel, Johnson, Lipmann, Najjar, Neuberg, Ochoa, Racker. Each major topic was first comprehensively reviewed and then followed by short reports of current work by selected participants. General discussion, led by the moderator, ensued. It is impossible to summarize the proceedings in brief space. Suffice it to say that the topic of carbohydrate metabolism, including new alternate pathways, was reviewed by Hassid, Horecker, and Leloir. The latter came from Argentina to report on newly discovered coenzymes, in particular uridinediphosphoglucose (UDPG). The metabolism of 2-carbon compounds, especially "active acetate" (acetyl-CoA), was reviewed by Barker; and Hunter and Lehninger discussed oxidative phosphorylation and electron transport. The P-containing coenzymes, particularly the structure and function of coenzyme A, received much attention (Kornberg and others). Schmidt provided a greatly needed review of the metabolism of pyrophosphates, metaphosphates, and polyphosphates. The influence of ions on phosphorylation (Lardy) and the thermodynamics of phosphate bonds (Oesper) were examined. Finally, a most interesting session dealt with the utilization of phosphate-bond energy in organisms. Muscular contraction (Mommaerts), electrical activity (Nachmansohn), bioluminescence (McElroy), peptide bond synthesis (Cohen), urea formation (Ratner), and carbon-dioxide fixation (Utter) were considered and afforded glimpses of expanding frontiers.

Like last year's symposium on Copper Metabolism, which was published by Johns Hopkins University Press, this one will appear in book form. A separate summary will be issued shortly.

BENTLEY GLASS

Department of Biology
The Johns Hopkins University

SCIENCE, founded in 1880, is published each Friday by the American Association for the Advancement of Science at the Business Press, 10 McGovern Ave., Lancaster, Pa. Entered as second-class matter at the Post Office at Lancaster, Pa., January 13, 1948, under the Act of March 3, 1879. Acceptance for mailing at the special rate postage provided for in the Act of February 28, 1925, embodied in Paragraph (d-2) Section 34.40 P. L. & R. of 1948.

All correspondence should be sent to SCIENCE, 1515 Massachusetts Ave., N.W., Washington 5, D. C. The AAAS assumes no responsibility for the safety of manuscripts or for the opinions expressed by contributors. Four weeks' notice is required for change of address, and an address stencil label from a recent issue must be furnished. Claims for a missing number will be allowed only if received within 60 days from date of issue.

Annual subscriptions, $7.50; single copies, $.25; foreign postage, outside the Pan-American Union, $1.00; Canadian postage, $.50. Special rates to members of the AAAS.

The AAAS also publishes THE SCIENTIFIC MONTHLY. Subscription and advertising rates on request.

MACMILLAN

Best Sellers from Macmillan

College Botany

Hylander & Stanley

This text for a year's course in general botany has four specific aims: (1) to secure a proper balance in the amount of subject matter devoted to each of the special fields of botany, (2) to suit the content and method of presentation to the needs of the student, (3) to develop an awareness of the importance of plant life, and (4) to utilize visual instructional materials in such a way that the illustrations become actual teaching aids. *1949—$5.00*

Biology of the Vertebrates, *3rd Ed.*

Walter & Sayles

In revision, Professor Sayles has retained the mellow, humane style of earlier editions but has added much up-to-date information. The third edition has been enriched by many new illustrations. Chapters on vertebrate types, embryology, skeleton, nervous system, and sense organs are rewritten in the light of recent advances in the field. *1949—$6.00*

Fundamentals of Comparative Embryology of Vertebrates, *Rev.*

Huettner

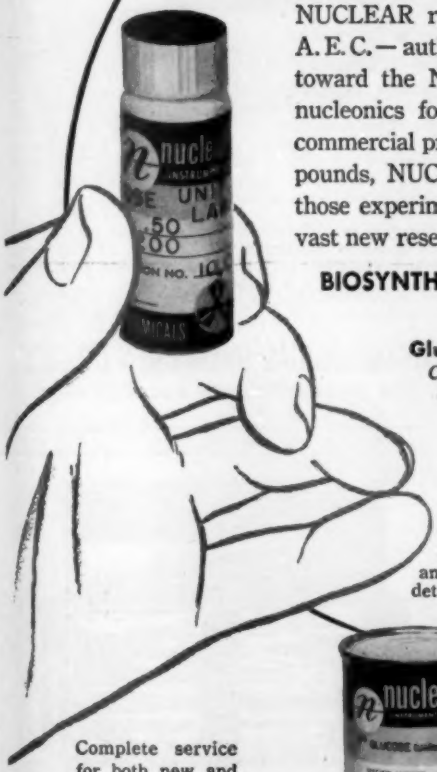
The revised edition of this popular book follows the same general plan of organization and maintains the same morphological point of view. Chapter I takes the place of the Introduction presenting a historical account of progress in embryology. The next four chapters deal with the general aspects of embryology, cytology, and genetics in relation to genetics and endrocrinology. *1949—$5.00*

THE MACMILLAN COMPANY

60 FIFTH AVENUE, NEW YORK 11, NEW YORK

nuclear

Radioactive Chemicals



NUCLEAR radioactive chemicals, now available to A. E. C.— authorized users, represent another step toward the NUCLEAR aim of *complete* service in nucleonics for science and industry. As the only commercial producer of biosynthetically labeled compounds, NUCLEAR is prepared to fill the needs of those experimenting or contemplating work in this vast new research field.

BIOSYNTHESIZED C^{14} LABELED COMPOUNDS NOW AVAILABLE FROM STOCK

Glucose • Sucrose • Fructose • Starch

Characteristics:

- Chemically pure
- Uniformly labeled with C^{14}
- Specific activity:
  Normally, 0.5 microcuries/milligram
  (Higher specific activities by special request)

Nuclear is also making chemically synthesized compounds such as carboxyl labeled Sodium Acetate — other special compounds to be announced. Write to NUCLEAR for details on radioactive compounds.

Complete service for both new and established laboratories—help on isotope procurement, authorizations, laboratory layout, and equipment facilities.

nuclear INSTRUMENT & CHEMICAL CORPORATION
237 West Erie Street • Chicago 10, Illinois • Cable Address: Arlab, New York

- Scaling Units For Every Type of Radiation Counting
- Complete "Packaged" Counting Systems
- Health Monitoring Instruments for Personnel Protection
- Glass Wall, Mica Window, and Windowless Counters
- Portable Count Rate Meters
- Radioactive Chemicals
- Complete Line of Accessories for the Nuclear Laboratory

nuclear "PRECISION INSTRUMENTATION FOR NUCLEAR MEASUREMENTS"

THE Editors of SCIENTIFIC AMERICAN are privileged to announce publication of a special issue devoted wholly to an assay of our country's most precious resources—its people and its brainpower.

The rising demand in our economy for intellectually trained and able personnel now raises a serious question of supply: "Can our population continue to produce enough people with the specialized abilities necessary to staff and administer our complex society?"

Able investigators in many fields have assembled a wealth of information that will play a decisive part in the plans of industry and in many areas of public policy from strategy in foreign affairs to secondary education.

For every responsible citizen, this extraordinary issue should provide an authoritative foundation for a realistic understanding of his own place and that of 150,000,000 U. S. citizens among two and one-half billion members of the human race at this epoch in world history.

In anticipation of the widespread demand for this important issue of SCIENTIFIC AMERICAN, a limited number of extra copies are being made available for new subscribers who share a responsible concern in the advance and use of scientific knowledge. You are invited to accept this invitation to receive SCIENTIFIC AMERICAN for the next nine months at the special introductory rate of only $3, saving you $1.50 from the single-copy price (ten months for cash with order). The September Human Resources issue will be sent to you at once.

SCIENTIFIC AMERICAN 24 W. 40th St., N. Y. 18, N. Y.

Sirs:
Please enter my subscription at the special rate of 9 months for $3, starting with the September Human Resources issue.
☐ Payment enclosed* ☐ Bill me later

Name .....
Address .....
City ..... Zone .... State .....
Business Connection .....
* Save us billing costs by sending payment now and receive an extra issue free. S-91

PC

Immediately Available for Research Investigators

GELATIN GLUTATHIONE

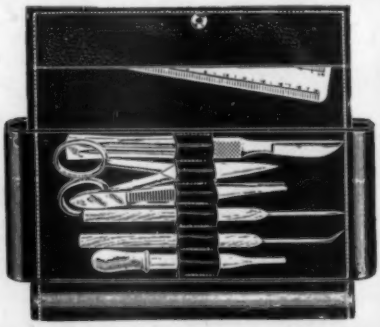
- For intravenous use as a blood extender in shock burns, radiation injury, severe depletions of fluid and toxic infections.
- As a new field for investigation in rheumatic fever, arthritis and in ACTH induced diabetes.

Gelatin in hydrolysis is well known to yield a non-antigenic product. Glutathione is the tripeptide of the three amino acids glycine, cysteine and glutamine used in biologic detoxifications. Glutathione increases the osmotic pressure of gelatin 20% and inhibits syneresis (ageing of colloids) thus advancing gelatin usefulness.

Supplied in 500 cc vials, sterile, ready for use intravenously containing 6% gelatin (knox) and 0.5% glutathione S H (reduced form) or S S (oxidized form) as desired.

Bibliography on Request *U. S. Patent #2,110,178*

PHYSIOLOGICAL CHEMICALS CO., INC.
3 LE FEVRE LANE, NEW ROCHELLE, N. Y.



No. 2A DISSECTING SET ..... $2.00 each
Less 10% on 6 dozen or more
A very popular college set. Other sets listed in our catalogue or we shall make up sets according to your specifications.

No. 19F Doublet Magnifier 10X Metal Mount ea. $3.25

THE GRAF-APSCO COMPANY
5868 Broadway Chicago 40, Ill.

SPECTROPHOTOMETRY'S WINNING "DAILY-DOUBLE"....

Coleman Jr.

MODEL 6 SPECTRO-PHOTO-METER

For rapid routine analysis, control and research where only spectrochemistry is worked. Complete with plastic light shield, mounting pads, transmittance-density scale, operating directions and constant voltage transformer. For use on 110-120 volts, 60-cycle. A.C. only **$460**

The Combination of a

COLEMAN

SPECTROPHOTOMETER

PLUS

FISTER'S MANUAL of STANDARDIZED PROCEDURES

for

SPEED . . . PRECISION . . . RELIABILITY!

A Coleman instrument and Fister's "Manual of Standardized Procedures for Spectrophotometric Chemistry" assures the user of the most accurate and simplest way possible to achieve the ultimate results in clinical chemistry. Ten years of analytical procedures have been built around the Coleman Spectrophotometers—ten years of service have proven their ability to increase output and to lower costs in the laboratory.

MODEL 14

Coleman Universal

SPECTROPHOTOMETER

A multi-purpose instrument for spectrochemistry that can be adapted for photofluorometry, nephelometry and spectro and electro titrations. Supplied with topcarrier, filter, transmittance-density scale, mounting pads, operating directions and constant voltage transformer. For use on 110-120 v., 60-cycle A.C. only. **$635**

Fister's

MANUAL OF STANDARDIZED PROCEDURES

for

SPECTROPHOTOMETRIC CHEMISTRY

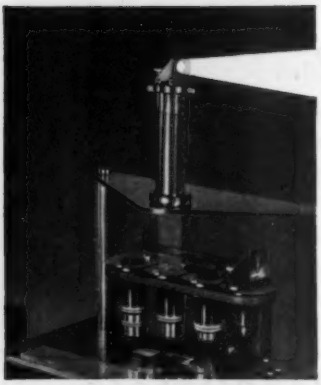
Contains 224 METHODS for the determination of 115 SUBSTANCES in various biological fluids; includes 115 CALIBRATION CURVES and 6 CHARTS. No fewer than 339 TESTS and 6 CHARTS. No from the 728 PAGES of this manual that will pay for itself many times over. **$30**

WRITE FOR DESCRIPTIVE BULLETINS.

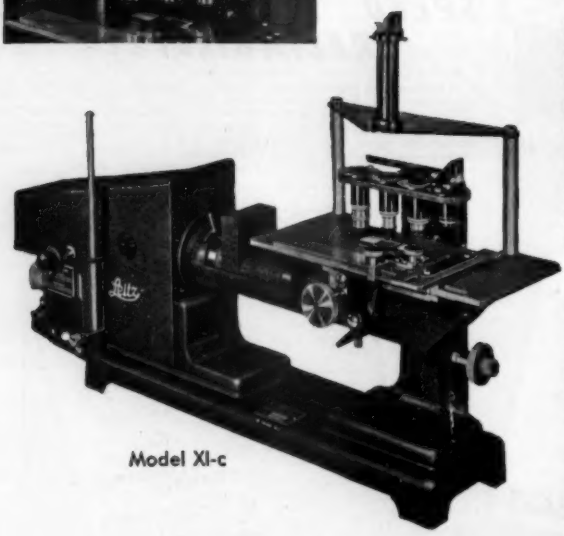
STANDARD SCIENTIFIC SUPPLY CORP.
34 West 4th Street New York 12, N. Y.

for visual demonstration at its best . . .

Leitz



Micro-Projectors



Model XI-c

For supreme optical precision and performance, no micro-projector surpasses the Leitz Model XI-c.

The illuminating equipment and special microscope of the XI-c are mounted on a common base to form a self-contained unit. The mechanical stage is arranged *horizontally*, and the *magnification is varied by sliding the entire stage platform forward or back*. The same area of the specimen remains in the center of the projected image, regardless of which magnification is used.

Ideal for use in classroom, lecture hall, hospital or institutional staff meetings, industrial and research laboratories. A complete selection of additional optical equipment, and lighting accessories is available to meet particular reauirements.

FEATURES

Synchronous objective-condenser changer
Horizontal built-in mechanical stage
Built-in condenser for each objective
Same area of specimen remains in center of projected image, at all magnifications
Parfocalized objectives
Coarse and fine controls arranged on common axis

For details, write Dept. 103S

E. LEITZ, Inc., 304 Hudson St., New York 13, N. Y.

LEITZ MICROSCOPES • SCIENTIFIC INSTRUMENTS • BINOCULARS
LEICA CAMERAS AND ACCESSORIES

ANNOUNCING A NEW JOURNAL

experimental parasitology

The new periodical will publish papers dealing with all experimental approaches to problems in the field of parasitology; contributions that involve experimental physiological, metabolic, biochemical, nutritional, and chemotherapeutic problems of parasites and host-parasite relationships are expected to form a major part of the contents. In addition to original research material a section of the journal will be devoted to "Parasitological Reviews," covering all aspects of parasitology. These Reviews will be prepared upon invitation of the editors.

Manuscripts should be submitted to D. R. Lincicome, Managing Editor, "Experimental Parasitology," P.O. Box 208, Newark, Delaware. Subscription orders will be accepted by Academic Press, Inc., 125 East 23 Street, New York 10, New York.

One volume consisting of four numbers will be published, at $8.00 per volume. **The first issue will be released in October 1951 and will contain the following papers:**

Editorial Board

H. H. Anderson
T. von Brand
E. Bueding
A. C. Chandler
E. C. Faust
J. D. Fulton
Q. M. Geiman
G. van Grembergen
C. G. Huff
D. R. Lincicome
J. Oliver-Gonzalez
C. B. Philip
W. P. Rogers
J. D. Smyth
N. R. Stoll

CLARK P. READ, University of California
Studies on the Enzymes and Products of Carbohydrate Degradation in the Cestode, *Hymenolepis diminuta*

E. S. EVANS and M. A. STIREWALT, Naval Medical Research Institute
Variations in Infectivity of Cercariae of *Schistosoma mansoni*

E. C. DOUGHERTY, University of California
The Axenic Cultivation of *Rhabditis briggsae* Dougherty and Nigon, 1949 (Nematoda: Rhabditidae). II. Some Sources and Characteristics of "Factor Rb"

J. WALTER BECK, The Rice Institute
Effect of Diet upon Singly-Established *Hymenolepis diminuta* in Rats

THEODOR VON BRAND, National Institutes of Health
The Gaseous Exchanges of Trypanosome-infected Rats

M. NAKAMURA and H. H. ANDERSON, University of California
Evaluation of Some Chemotherapeutics against *Endamoeba histolytica* in Cultures with *Trypanosoma cruzi*

ELVIO H. SADUN, Johns Hopkins University
Gonadal Hormones in Experimental *Ascaridia galli* Infections in Chickens

REGINALD D. MANWELL and HANS P. DROBECK, Syracuse University
Mammalian Toxoplasmosis in Birds

P. C. C. GARNHAM, University of London
An Attempt to Find the Vector of *Hepatocystis* (=*Plasmodium*) *kochi* (Levaditi and Schoen)

ACADEMIC PRESS INC., Publishers

125 East 23 Street, New York 10, N. Y.

Before You Buy!

. . . CHECK THESE B&L "PLUS SERVICES"

. . . services that are particularly important today due to the increased availability on the American market of instruments which are sold on an "all sales final" basis.

Instrument Sales Engineering—*Before you buy,* invite a B&L sales engineer to review your problems. He may save you time and money by suggesting an unfamiliar new instrument, or a new accessory that increases the scope of your present equipment.

Service Engineering—With proper care a B&L instrument is yours for a lifetime of dependable daily use. Many B&L dealers provide prompt service, in addition to the complete B&L factory service which is always available.

Nation-Wide Instrument Dealer Organization—Free demonstrations of B&L instruments; valuable counsel on your instrumentation problems; quick fulfillment of your orders, often from stock. Your B&L dealer renders these services promptly and capably, without obligation.

Educational Material—Films, slides, booklets, charts (almost all free of charge) to help teach scientific principles, and familiarize students with proper techniques and instrumentation.

WRITE for additional information on these B&L "PLUS SERVICES" to Bausch & Lomb Optical Co., 642-13 St. Paul Street, Rochester 2, N. Y.

Bausch & Lomb *Scientific* Instruments

Radiocarbon Dates, II[1]

W. F. Libby

Institute for Nuclear Studies and *Department of Chemistry*
University of Chicago, Chicago, Illinois

The dates obtained since the publication of the first date list (*1*) are presented below. This list covers the period September 1, 1950, to September 1, 1951. The dates quoted are based on 5568 ± 30 years as the half-life of radiocarbon (*2–5*). The number of runs is indicated by the number of dates listed. When the later runs were merely remeasurements of the carbon obtained from a single combustion, brackets are placed around the set of dates; otherwise separate portions of the original sample were processed and measured. The counting time has been limited to 48 hr in most cases.

RADIOCARBON DATES

I. *Mesopotamia and Western Asia*

(Principal collaborators: R. J. Braidwood, T. Jacobson, Richard A. Parker, and Saul Weinberg.)

A. Egypt

Our No.	Sample	Age (years)
550 and 551	*Upper K*: wheat and barley grain from Upper K Pit No. 59, Jar 3, and another of the Upper K Pits (No. lost), of the Fayum A material, as described in *The Desert Fayum*. Submitted by Gertrude Caton-Thompson, Cambridge, and Elise Baumgartel, Museum of The University of Manchester.	6391 ± 180

E. Iran

525 and 574	*Belt Cave* (Ghar-i-Kamarband): Five miles west of Behshahr at the southeast corner of the Caspian Sea; stratified cultural deposit 4.05 m thick containing from bottom to top Mesolithic, late Mesolithic, Neolithic, late Neolithic, and Bronze Age materials. Burned bone which was treated by dissolving in hydrochloric acid to separate the charred carbon, which was measured. Collected and submitted by Carleton S. Coon, University of Pennsylvania Museum.	

[1] The author gratefully acknowledges the generous financial support afforded by the Wenner-Gren Foundation for Anthropological Research, Inc., formerly The Viking Fund, Inc., New York, and wishes to thank Frederick Johnson, Donald Collier, Richard Foster Flint, and Froelich Rainey, the members of the Committee on Carbon 14 of the American Anthropological Association, and the Geological Society of America for their indispensable direction and assistance throughout this research.

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
525	Supposedly from same levels as 574. Comment: Looks intrusive or altered.	1130 ± 300 1260 ± 430
574	Zone containing upper Mesolithic artifacts, 1.25–2.15 m deep (Layers 15 and 16).	8545 ± 500

F. Palestine

576	*Bible*: Dead Sea scrolls. Book of Isaiah; linen wrappings used. Found in cave near Ain Fashkha in Palestine by Pere de Vaux (OP) under supervision by G. Lankester Harding, curator, Department of Antiquities of the Jordan government. Thought to be first or second century B.C. Brought for test by James L. Kelso at suggestion of Ovid R. Sellers and with permission of Mr. Harding. Submitted directly by C. H. Kraeling, Oriental Institute, University of Chicago.	1917 ± 200

II. *Western Europe*

(Principal collaborators: H. L. Movius, E. S. Deevey, Jr., and R. F. Flint.)

A. France

577	*France I*: Material from a late upper Paleolithic (Magdalenian) occupation layer overlain by 1.5–2 m of rock fall. Collected in and around a hearth which measured 60 cm in diameter and 10 cm in thickness at the center. Found at La Garenne, St. Marcel (Indre), France. Consisted of 1,500 g burned bone from which sufficient organic material was obtained by acid dissolution of the bone. Submitted by J. Allain, 34 Ave. Thabaud-Boislareine, Neuvy St. Sepulchre (Indre), France, via H. L. Movius, Harvard.	11,109 ± 480
578	*France II*: Same as 577, except that it consisted of an ashy material with sand, charcoal, and burned bones.	15,847 ± 1200

Our No.	Sample	Age (years)
579	*France III*: Same as 577 and 578, except found outside the hearth but in same horizon. Burned bone.	12,986 ± 560
588	*Lake Bourget*: Lake Bourget wood and peat samples taken along road between Chambéry and Grenoble in southeastern France. Should be interglacial or interstadial. This sample was wood from 2″ above base of level 3d, the lowest lignite bed in the exposure between La Flachère and La Brussère (Isère). Donor's sample No. 1. Submitted by H. L. Movius.	At least 21,000
595	*Geneva*: Wood from peat bed in Dranse Valley east of Geneva and south of Lake Geneva in France rather than Switzerland. Submitted by H. L. Movius.	At least 19,000
	B. Germany	
449	*Overbeck Top*: Peat from 0 to 2 cm above the dry horizon described in Sample 450 (*1*). Submitted by F. Overbeck.	1129 ± 115
	C. Denmark	
435	*Danish House*: Birchwood from the same area as samples 433 and 434 (*1*). From House 2. Probably a few years younger than House 1. Submitted by J. Troels-Smith, National Museum, Copenhagen. Comment: Seems to agree with 433 and possibly 434, giving a general mean of 9479 ± 280 years.	9425 ± 470
	D. Ireland	
356	*Irish Post-Glacial*: Lake mud, Lagore, County Meath. Early Post-Glacial, Zone IV. Submitted by G. F. Mitchell (his sample No. I-B).	11,787 ± 700
	E. England	
602	*Stonehenge*: Charcoal sample from Stonehenge, Wiltshire, Eng. Taken from hole No. 32 of a series of holes that are believed to have been used for some sort of ritual. These holes belong to the first phase of the monument and are considered to be late Neolithic. Submitted by Stuart Piggott, University, Edinburgh.	3798 ± 275

Our No.	Sample	Age (years)
	III. United States	
	(Principal collaborators: E. S. Deevey, Jr., R. F. Flint, J. B. Griffin, R. F. Heizer, F. Johnson, F. H. H. Roberts, and W. S. Webb.)	
	A. New England	
478	*Linsley V*: Peat from Upper Linsley Pond, Conn. Taken at 10.55 m with large sampler. Pollen date is early to middle C-1. Pine zone is at 11.90 m. Collected and submitted by E. S. Deevey, Jr.	8794 ± 550
	C. Iowa, Illinois, Kentucky, Pennsylvania, Ohio, and Indiana	
575	*Wedron*: Wood from Lake Kickapoo deposits at Wedron, Ill. From dark peaty silt occurring in a bedrock valley in St. Peter sandstone in the same quarry and position as sample No. 535 (*1*). Wood horizon is overlain by periglacially deformed sand and dark silt, which in turn underlie laminated clay (Lake Kickapoo deposits). These lie under a series of tills which have been regionally correlated by L. Horberg and others. The lowest of these is Bloomington, so the sediments must be early Tazewell (either Bloomington or Shelbyville). Collected by H. Bretz and transmitted by Jerry Olson. It was taken as a check on Sample 535.	Older than 17,000
526	*Lake Lundy*: Wood from Bellevue, Ohio, ¾ mile northwest of Castalia on the 620 contour near the first "r" in Margaretta. This falls within the higher limit of Lake Lundy (Grassmere) but above the Elkston limit. Lake Warren beaches are 50′–60′ higher. Submitted by R. P. Goldthwait, Ohio State University.	8513 ± 500
508	*Camden*: Wood from Camden moraine, south of Dayton, Ohio. Sample 465 (*1*) was from the outer limit of the drift of which the Camden moraine is a recessional moraine. This may be Cary. Submitted by R. P. Goldthwait.	Older than 17,000
509	*Farmdale II*: Wood found 0′–1′ below surface of the Farmdale	Older than 19,000

Our No.	Sample	Age (years)
	loess at Farm Creek, Ill. Same site as Sample 510 (*1*). Submitted by Guy D. Smith.	
500	*Lake Cicott*: Peat from Lake Cicott bog, Ind. Collected from 22′–23′-depth, combined Samples G, H, I, L, M, B. Thought to be Zone C-1, Zone B boundary. Collected by J. E. Potzger, Butler University, Indianapolis, Ind., and submitted by E. S. Deevey, Jr.	5625 ± 310
	D. West Virginia, North Carolina, and South Carolina	
474	*Singletary Optimum*: Peat from highest of the three organic horizons at Singletary Lake, N. C. Same site as Sample 475 (*1*). Submitted by David G. Frey.	10,224 ± 510
	E. Louisiana, Missouri, Mississippi, Nebraska, and Texas	
558	*Folsom Bone*: Burned bison bone from Lubbock, Texas, from the Folsom horizon. Submitted by E. H. Sellards, Texas Memorial Museum, Austin. Mr. Sellards' description: "This burned bone has been collected by Glen Evans and Grayson Meade of our staff. We are entirely satisfied that the horizon is Folsom. This conclusion that it is Folsom is based on two principal observations. We have, as you know, a thoroughly proven section at Clovis, New Mexico, the succession being a gray sand containing elephant, other fossils, and artifacts as the basal stratum of the section, followed by a deposit containing a large percentage of diatomaceous earth as the second stratum. The elephant is absent from this second stratum, and instead we have an abundance of bison. At the Lubbock locality exactly these conditions are repeated, gray sand as the basal stratum with elephant as the most common fossil, followed by the diatomaceous material with the extinct bison as the abundant fossil. Later units are present at both localities. At the Clovis locality the Folsom culture is contained in and confined to this second horizon. At the Lubbock locality Folsom culture is present as shown by the fact that we have found Folsom points thrown out in the course of dredging. We have not yet found them in place in the diatomaceous deposit, but are fully convinced that they will be found in place as excavating proceeds."	9883 ± 350

RADIOCARBON DATES—(*Continued*)

Our No.	Sample	Age (years)
469	*Cedar Canyon*: Charcoal from Cedar Canyon, Neb., locality 8x-101. Found in buried hearth (*cf. Am. Naturalist*, 70, 359 [1936]). Submitted by C. B. Schultz.	1993 ± 190 2379 ± 430 Av. 2147 ± 150
153	*Davis*: Corncobs from Davis site, in eastern Texas. Nos. 5888, Jones 3497. Submitted by Alex Krieger, University of Texas, via James Griffin.	1553 ± 175
	F. Arizona, California, and New Mexico	
567–573	*Bat Cave*: Charcoal all from one area in Bat Cave. From levels from which there has been no vandalism and little opportunity for mixture by rodent activity. Submitted by Paul C. Mangelsdorf, Harvard. The development of the corn culture presumably is correlatable with the charcoal dates.	

Sample No.	*Location*	
567	Area III, Section Ie, Front, 11″–15″ depth	1610 ± 200
569	Area III, Section Ie, Rear, 24″–36″ depth	2816 ± 200
570	Area III, Section Ie, Front, 36″–48″ depth	2048 ± 170
571	Area III, Section Ie, Front, 48″–60″ depth	5605 ± 290
572	Area III, Section Ie, Front, 54″–66″ depth	5000 to 7500 (poor run)
573	Area III, Section Ie, Front, 60″–66″ depth	5931 ± 310

584	*Tularosa Cave I*: Corncobs from Tularosa Cave in west central New Mexico, in which a stratified refuse deposit with 38,000 cobs of a primitive type, together with other cultivated plant material, was found. This sample of cobs was from Square 2R2, Level 14, the lowest occupation level resting on sandstone bedrock 9′ 4″ from the surface of the dry midden. Submitted by Paul S. Martin, Chicago Natural History Museum.	2223 ± 200

Our No.	Sample	Age (years)
585	*Tularosa Cave II*: Cobs and tree bark from Tularosa Cave in west central New Mexico. This sample was taken from Square 2R2, Level 10, 6′ 8″ below the surface. This layer is the Pine Lawn phase, the first pottery-making period of the area. Submitted by Paul S. Martin via Donald Collier.	2112 ± 230 2177 ± 225 Av. 2145 ± 160
612	*Tularosa Cave III*: Corn and vegetable material from Tularosa Cave (*cf.* 584 and 585), Square 2R2, Level 13. Pre-pottery and associated with Chiricahua-type implements. Submitted by Paul S. Martin.	2300 ± 200
518	*San Pedro II*: Charcoal from Pearce 8: 9, Cochise Site #3, San Pedro stage. Sulphur Spring Valley, Ariz. Submitted by E. B. Sayles.	1762 ± 430
615	*Searles Lake*: Searles Lake, Calif., organic matter from mud seam separating upper and lower salt deposits of Searles Lake, believed to have been deposited by flood waters during last glaciation. Organic matter was extracted with acetone, evaporated to a thick syrup, and the resinous material precipitated by adding water. Donor's sample No. 2. Submitted by W. A. Gale, American Potash and Chemical Corp., Trona, Calif.	At least 16,000
628	*Big Sur*: Charcoal from shell midden on California coast at mouth of Willow Creek about 30 miles south of Big Sur on coast of Monterey County. Midden overlain by 10′ of gravels. Present beach gravels submerge 4.5′ of midden, indicating shore subsidence. Submitted by R. F. Heizer, University of California, Berkeley.	1879 ± 250
	G. Nevada, Oregon, and Utah	
599	*Leonard Rock Guano*: Bat guano taken from immediately next the Pleistocene gravels in the Leonard Rock Shelter, Nev. Submitted by R. F. Heizer.	11,199 ± 570
276	*Lovelock III*: Vegetal material, earliest occupation level, Lovelock Cave (LCB). Submitted by R. F. Heizer.	2452 ± 280 2517 ± 320 Av. 2482 ± 260
587	*Humboldt*: Basketry from Humboldt Cave in Nevada, excavated in 1936. This cave is some 10 or 12 miles west of Lovelock Cave. Submitted by R. F. Heizer.	1953 ± 175
609	*Danger Cave I*: Charcoal, wood, and sheep dung from Danger Cave, near Wendover, Utah. Found on old beach of Lake Stansbury, consisting of 2′ of sand deposited on cemented gravels. Both sheep dung and wood were found in the sand layer. Above this several feet of later deposits lie. This sample was sheep dung from donor's F #18 FS #535. Submitted by Jesse D. Jennings, University of Utah.	11,453 ± 600
610	*Danger Cave II*: Same as 609, except wood.	11,151 ± 570
	I. South Dakota	
604	*Long Site*: Charcoal from the Long Site (39FA65) in the Angostura area of southwestern South Dakota. The charcoal was taken from an oval-shaped unprepared hearth (Feature 14) 2.1′ long and 1.5′ wide in the west center of Square N3E3. Part also was taken from a small surrounding area. Donor's sample No. 39FA65-417. Collected by Richard P. Wheeler in the summer of 1950 in the field party of Paul L. Cooper, River Basin Surveys, University of Nebraska. Submitted by Paul L. Cooper.	7073 ± 300
	J. Alaska	
563	*Denbigh Log*: Base log from Paleo-Eskimo house 7-IYH7; Cape Denbigh, Iyntayet site. Submitted by F. Rainey.	2016 ± 250
505	*Alaska I*: Spruce wood from Hillside (Okvik House), Gambell, St. Lawrence Island, Alaska. Excavated by Giddings in 1939. Submitted by F. Rainey.	2258 ± 230
560	*Trail Creek*: Willows and charcoal from 80-cm depth in Cave 9 at Trail Creek, Alaska. Submitted by F. Rainey.	5993 ± 280
301	*Fairbanks Creek*: Wood from 30′–60′ depth on Fairbanks Creek, Fairbanks, Alaska. Associated with extinct mammal bones. Submitted by Wendell Oswalt, Uni-	12,622 ± 750

Our No.	Sample	Age (years)
	versity of Alaska Museum, College.	
V.	*South America* (Principal collaborator: J. B. Bird.)	
323	*Peruvian Rope*: Rope in excellent condition from cache in lowest layer (D) of Huaca Prieta Mound No. 1. Associated with early Negative (Gallinazo) pottery. Submitted by J. B. Bird.	2632 ± 300
362	*Chicama VII*: Sample of cattail roots from Layer K-2 of Huaca Prieta Mound No. 3. Should be between samples 316 and 318 (*1*). Submitted by J. B. Bird via H. C. Cutler, Chicago Natural History Museum.	4044 ± 300
598	*Huaca Prieta*: Charcoal from the lowest occupation level of Huaca Prieta No. 2, found directly on bedrock by Constante Lareo, under the direction of J. B. Bird. Submitted by J. B. Bird.	4298 ± 230
619	*Mochica Rope*: Rope from a late Mochica burial at Huaca de la Cruz in the Virú Valley. Associated pottery indicates it dates from the latter part of the Mochica period as recorded in the Virú, the first valley south of Moche. Submitted by W. D. Strong, Department of Anthropology, Columbia University, via J. B. Bird.	1838 ± 190
VII.	*Other Areas*	
548	*Japanese*: Charcoal from Ubayama shell mound, about 10 miles west of Tokyo, Japan. Charcoal was part of structural remains in a house area in the bottom levels of the mound. Found in fall of 1948. Thought to be oldest house site in Japan. Submitted by Ralph D. Brown, 26 W. Rustic Lodge Ave., Minneapolis, Minn. Similar sample submitted by Lt. Col. H. G. Schenck. This sample was not measured.	4850 ± 270 3938 ± 500 Av. 4546 ± 220
603	*Late Jomon*: Charcoal collected by Father Groot from the early Late Jomon (Horinouchi Stage) horizon at the Ubayama shell mound (*cf.* 548) in Japan. Submitted via H. L. Movius.	4513 ± 300

Our No.	Sample	Age (years)
580	*West Africa*: Late Stone Age Lupembian stone blade associated with carbonized wood from a late Upper Pleistocene deposit at Mufo, Angola, Portuguese West Africa. Found on the eastern bank of the Luembe River (7° 38′ S, 21° 24′ E). Stratigraphy was gray-white sand at surface 2.50 m thick. At the base of this the Lupembian (late Stone Age) backed blade was found in mint condition, unworn, and associated with the carbonized wood measured. Next below the sand was a gravel layer 65 cm thick, next a ferritized gravel layer 5 cm thick, then a gravel layer identical with the second layer from the surface. This was 10 cm thick and rested on the bedrock of mica schist. Submitted by J. Janmart, Museo do Dundo, Comparrhia de Diamantes de Angola, Dundo-Lunda, Angola, via H. L. Movius.	11,189 ± 490
581	*West Africa*: Carbonized wood found 15 cm down in the gravel layer underlying sample 580. Submitted by J. Janmart via H. L. Movius.	14,503 ± 560
540	*Hawaii*: Charcoal from earliest Polynesian culture in Hawaii. Found in Kiliouou Bluff Shelter, Kuliauaw, Oahu Island, by Kenneth P. Emory, Bernice P. Bishop Museum, Honolulu. Submitted by K. P. Emory.	946 ± 180
600	*Australia A*: Aboriginal kitchen midden charcoal from Australia, taken from Goose Lagoon, Western Victoria, on property called "Leura" east of Goose Lagoon. The midden was on the north side of the aeolianite region and toward its east end, about 15′ above the alluvium flat. Collected by Edmund D. Gill, National Museum of Victoria, Melbourne. Submitted by H. L. Movius.	1177 ± 175
601	*Australia B*: Aboriginal kitchen midden charcoal from Australia, taken from Koroit Beach at Armstrong's Bay, northwest of Warrnambool, Victoria. Collected by Edmund D. Gill. Submitted by H. L. Movius.	538 ± 200

Our No.	Sample	Age (years)
606	*Waterton*: Western Alberta, Canada, glacial forest bed in northwest quarter, Sec. 8, T. 2R. 29 at Waterton (*cf.* Waterton Lakes topographic map). Stratigraphy: Topsoil, 1′; gravel, 12′; lacustrine clay, 6″; gravel, 2′; sandy silt with invertebrate fossils, 2′; forest bed, 2′; dark-brown Keewatin drift, 9′. This sample was wood. L. R. Wilson, University of Massachusetts, says it is black-and-white spruce. The ecology is similar to that at edge of tundra now. Submitted by Leland Horberg, University of Chicago.	3261 ± 250
607	*Waterton Peat*: Same as 606, except peat instead of spruce wood.	3327 ± 320
629	*Seeds*: Ancient Manchurian lotus seeds, still fertile. Collected by Ichiro Ohga in the Pulantien Basin of South Manchuria in a peat layer presumably of Pleistocene age; uplift and erosion had exposed the layer on the walls of the Pulantien River valley. Ohga germinated several hundred seeds, either filing the thick outer shell or soaking seeds in concentrated sulfuric acid for 1–5 hr. Genus *Nelumbo*, similar to the Indian lotus *N. nucifera*. Submitted by R. W. Chaney, University of California, Berkeley.	1040 ± 210

References

1. Arnold, J. R., and Libby, W. F. *Science*, **113**, 111 (1951).
2. Engelkemeir, A. G., *et al. Phys. Rev.*, **75**, 1825 (1949).
3. Jones, W. M. *Ibid.*, **76**, 885 (1949).
4. Miller, W. W., *et al. Ibid.*, **77**, 714 (1950).
5. Engelkemeir, A. G., and Libby, W. F. *Rev. Sci. Instruments*, **21**, 550 (1950).

Technical Papers

Some Properties of an Ascorbic Acid Oxidation Inhibitor in Vegetables[1]

Barbara J. Branthoover[2] and Margaret McGregor Hard

State College of Washington, Pullman

During the course of previous work in this laboratory, it was observed that the ascorbic acid content of frozen spinach decreased more rapidly during freezer storage than did the ascorbic acid content of frozen snap beans (*1*). Variations in the processing method (scalding, cooling, or type of package) did not appreciably affect this rate of loss. However, several workers (*2–8*) have shown that some vegetables have an inhibiting effect on the oxidation of ascorbic acid. Spinach has some inhibitory effect (*3, 7*) but its action is very slight as compared to the effect of vegetables such as snap beans, cauliflower, and cabbage. The purpose of this study was to investigate some of the chemical and physical properties of the inhibitor of ascorbic acid autoxidation in frozen snap beans.

In order to eliminate as many variables as possible, and also to accelerate the rate of autoxidation, a method was devised in which the ascorbic acid solutions were maintained under constant oxygen pressure and at a constant temperature. Gas bottles holding the samples were kept in a water bath at 35° C. Oxygen was supplied to the samples from an oxygen tank through a glass manifold with 12 side outlets to which the gas bottles were attached. In order to facilitate keeping the pressure constant from experiment to experiment, a mercury manometer (15-in. CODC Standard Cleanout Manometer) was connected to the other end of the manifold.

Solutions of snap-bean extract to be tested for their effect on ascorbic acid autoxidation were pipetted into duplicate gas bottles. Fifty ml of ascorbic acid solution, containing 2 mg ascorbic acid, was added to each gas bottle, the mixture shaken, and a 5-ml aliquot removed and combined with an equal amount of 2% *m*-phosphoric acid solution preparatory to reduced ascorbic acid determinations.

When the 12 gas bottles were thus set up, they were placed in the water bath and attached to the manifold. In order to saturate the solutions with oxygen, the pure gas was bubbled through them for 6 min at a rate of 8 liters/min, as determined by an oxygen flow meter (Linde Oxygen Therapy Flow Meter Type L-14). The system was then closed, and, on the basis of the barometric reading, the oxygen pressure was increased until equivalent to 69.86 cm Hg and was

[1] Scientific Paper No. 1017, Washington Agricultural Experiment Stations, Institute of Agricultural Sciences, State College of Washington, Pullman.

[2] Present address: Department of Foods and Nutrition, University of Hawaii, Honolulu. This paper represents a portion of a thesis submitted in partial fulfillment of the M.Sc. degree in Home Economics.

TABLE 1

PROPERTIES OF AN ASCORBIC ACID OXIDATION INHIBITOR IN FROZEN SNAP BEANS

Experiment	Ascorbic acid retention (%)
I. *Concentration of inhibitor*	
Control*	38
Control + 5 ml snap-bean extract	86
" +5 " " " " diluted 10:100	90
" +5 " " " " " 5:100	86
" +5 " " " " " 2:100	63
" +5 " " " " " 1:100	60
II. *Stability of inhibitor*	
Control*	33
Control + 5 ml snap-bean extract	93
" +5 " " " " stored at 0° C, 1 week	93
" +5 " " " " " " −20° C, 1 "	94
" +5 " " " " " " −20° C, 2 weeks	93
" +5 " " " " " " −20° C, 3 "	94
III. *Volatility of inhibitor*	
A. Control*	33
Control + 5 ml snap-bean extract (pH 6.4)	86
" +5 " " " distillation residue (pH 6.1)	75
" +5 " " " distillate†	83
1. (pH 7.5)	88
2. (pH 8.1)	51
3. (pH 8.5)	
B. Control*	
Control + 5 ml snap-bean extract (pH 6.4)	43
" +5 " " " (pH 8.2)‡	94
" +5 " " " distillation residue (pH 7.7)	48
" +5 " " " distillate	43
1. (pH 9.2)	88
2. (pH 9.0)	95
3. (pH 5.9)	78

* 50 ml, 2 mg. ascorbic acid.
† Distillate was collected in three 30-ml fractions.
‡ Snap-bean extract brought to pH 8.2 with .2 *M* bisodium phosphate.

maintained at this level. This pressure had been previously found to give the desired rate of oxidation in the control samples.

Following a total oxygenation period of 45 min, the system was opened, each sample mixed, and a 5-ml aliquot removed from each bottle and combined with 5 ml of 2% *m*-phosphoric acid. The system was then put under oxygen pressure for another 45-min period, including the 6-min flushing time, after which the final aliquots of the 12 samples were removed and ascorbic acid determinations again made. The reduced ascorbic acid was measured by the method of Loeffler and Ponting (*9*).

In order to minimize the possibility of mineral contamination, glass-redistilled water was used for preparing all solutions. The snap-bean extract was prepared by mixing frozen snap beans with water, in a ratio of 1:3, for 10 min in a Waring Blendor. The blended material was then filtered, using coarse (No. 226 Reeve Angel) filter paper. The controls were pure solutions of ascorbic acid. Percentages reported as retained (Table 1) are those found after the second period of autoxidation under oxygen pressure, or after 1½ hr oxygenation. The pH of the test solutions ranged from 6.0 to 6.4. The protection exhibited by 5 ml of freshly prepared frozen snap-bean extract was used as the standard of comparison in evaluating the protection exhibited by fractions of the extract. The average amount retained by this standard was 88% of the amount initially present as compared with 35% retained by the control.

Typical data are presented in Table 1. Dilutions of the snap-bean extract (Table 1, Expt I) were made by diluting 10, 5, 2, and 1 ml of the original extract to a total volume of 100 ml with redistilled water. Five-ml aliquots of the respective dilutions were compared with 5 ml of undiluted extract in their ability to inhibit ascorbic acid autoxidation. It was found that the snap-bean extract diluted to 5% of the original concentration was as effective as the undiluted standard. More dilute extracts gave less protection to the ascorbic acid.

To test the stability of the inhibitor (Table 1, Expt II), samples of snap-bean extract were kept at room (20°–27° C), refrigerated (0° C), and freezer storage (−22° C) temperatures for periods of 1, 2, and 3 weeks. Those samples kept in freezer storage were as effective as the fresh snap-bean extract in inhibiting ascorbic acid autoxidation, but samples stored at temperatures above that of freezer storage varied in this respect.

Takahashi (*8*) reported that steam distillates of garden radishes, onions, and mustard were effective in inhibiting copper-catalyzed oxidation of ascorbic acid. To test the volatility of the autoxidation-inhibiting factor in the snap-bean extract (Table 1, Expt III),

a 100-ml sample of extract was distilled at atmospheric pressure. The distillate was collected in three 30-ml fractions, and the residue brought back to the original volume with redistilled water. Some of the distillates inhibited autoxidation, but, since it was not always possible to detect the inhibitory factor(s) in the distillates, it was felt that volatility of the factor(s) must depend on some unknown condition. Since the pH of the distillates was in the alkaline range (7.5–8.5), additional distillations of snap-bean extract were carried out, using alkaline snap-bean extracts that had been prepared by blending snap beans with solutions of dibasic sodium phosphate instead of water. It was found that as the pH of the snap-bean extract increased, the volatility and stability, as shown by storage studies, of the inhibitory factor(s) apparently increased, though at the high pH values (above pH 8), the extract itself did not show its usual strong inhibition of ascorbic acid autoxidation.

These results strengthen the existing evidence that vegetables contain an inhibitor(s) of ascorbic acid oxidation. Some of the properties of the inhibitor(s) in snap beans are also indicated. Further work is in progress to define more definitely the nature of the inhibitor(s).

References

1. Bedford, C. L., and Hard, M. M. *Proc. Am. Soc. Hort. Sci.*, **55**, 403 (1950).
2. Bach, E. *Z. Vitaminforsch.*, **15**, 297 (1945).
3. Bedford, C. L., and Hard, M. M. Unpublished data (1949).
4. Crook, E. M. *Biochem. J.*, **35**, 231 (1941).
5. Giri, K. V., and Seshagiriraо, P. *Proc. Indian Acad. Sci.*, **24B**, 264 (1946).
6. Kardo-Syeveva, E. K. *Proc. Sci. Inst. Vitamin Research USSR*, **3**, 170 (1941).
7. Reder, R. *Science*, **103**, 201 (1946).
8. Takahashi, E., *et al. J. Agr. Chem. Soc. Japan*, **20**, 495 (1944).
9. Loeffler, A. J., and Ponting, J. D. *Ind. Eng. Chem. Anal. Ed.*, **14**, 846 (1942).

Prolongation of Clotting Time in Dormant Estivating Mammals[1]

Arthur Svihla, Howard R. Bowman, and Ruth Ritenour

Department of Zoology, University of Washington, Seattle

During an investigation of the seasonal changes in blood volumes of ground squirrels of two species (*Citellus columbianus* and *C. parryii ablusis*), it was discovered that a prolongation of the clotting time of the blood normally occurs in these animals when they are in a dormant state.

The blood volumes were determined by Cartland and Koch's (*1*) micromodification of the Keith-Rowntree-Geraghty (*2*) plasma dye dilution method. Because of the relatively small size of the animals and the lack of large superficial blood vessels, sufficient blood could not be taken readily from the ears or tails as is ordinarily done in other experimental animals. Hence heart punctures, using a #23 hypodermic needle, were resorted to. By this method adequate amounts of blood could be secured, and blood volumes satisfactorily determined while the animals were still in an active state. When the animals became dormant either during estivation or hibernation, this method proved unsatisfactory. The primary disadvantage was that the animals usually died shortly after the blood samples were taken. It was revealed upon post-mortem examinations that death was caused by internal hemorrhages, the pericardial cavity being completely filled with blood. When a finer-gauge needle (#26) was substituted, blood samples could be taken without the accompanying pericarditis and resultant death.

It was at first assumed that the internal hemorrhages were due to faulty technique and that death was caused by a mechanical injury to the heart or adjacent blood vessels. However, when samples of the blood of the dormant animals were exposed to the air, they did not clot normally even after an exposure of several days. Hence death was not due to faulty technique but to a hemophilic condition of the blood.

Comparative studies on the clotting time of the blood of both active and dormant ground squirrels were then made. Three regular techniques, capillary tube, Lee and White's, and Howell's, were used. These methods of determining clotting time differ from each other essentially in the diameter of the tubes. The capillary tubes have the narrowest lumen, those used in Howell's technique the widest. As can be seen from Table 1, all produced similar results.

TABLE 1

No. animals tested	No. blood samples	Clotting time (min and sec) Minimum	Maximum	Av
		Capillary tube method		
16 active	30	0′ 33″	12′ 0″	4′ 34″
11 dormant	15	10′ 51″	51′ 45″	20′ 6″
		Lee and White's method		
10 active	10	3′ 41″	29′ 30″	14′ 36″
7 dormant	9	16′ 43″	39′ 0″	26′ 25″
		Howell's method		
5 active	5	4′ 30″	13′ 20″	8′ 12″
5 dormant	5	35′ 23″	68′ 30″	48′ 43″

The term active refers to all animals that were not in a truly dormant state and includes those that were drowsy. Some squirrels remained in the mid-state of drowsiness, neither completely active or completely dormant. The longest periods on clotting times for active squirrels were obtained from these drowsy animals.

In the really active ground squirrels a complete clot occurred and determined the end point of clot formation, whereas in the dormant animals a complete clot never did form. Only a partial clot formed even if the blood was exposed for several days.

The prolongation of blood-clotting time may be considered a remarkable adaptation of estivating

[1] Acknowledgment is made to Army Air Force contract A.F. 33 (038) 18509 for aid and assistance in conducting this investigation.

mammals to the dormant state. During estivation the heart beats very slowly, with a comparable decrease in the rate of blood flow, and hence any mechanism to prevent the formation of a thrombosis during the inactive state would be of considerable survival value to the animal. In the active state a hemophilic condition of the blood would, on the contrary, be a distinct detriment, for any slight injury involving bleeding could lead to death. In estivation, since the animals are buried underground in their nests, injuries are very unlikely.

The various factors involved in this prolongation of clotting time are being studied.

References

1. Cartland, F. F., and Koch, F. C. *Am. J. Physiol.*, **85**, 540 (1928).
2. Keith, N. M., Rowntree, L. G., and Geraghty, J. T. *Arch. Internal Med.*, **16**, 547 (1915).

Reversed Phase Partition Chromatography of Steroids on Silicone-treated Paper[1]

Theodore H. Kritchevsky[2] and Arne Tiselius

Biokemiska Institutionen, Uppsala, Sweden

The conventional procedure of paper partition chromatography, in which the paper holds water as a stationary phase, is not satisfactory when applied to a class of compounds such as the steroids, which have limited water solubility. This difficulty can be circumvented in a number of ways.

One solution would consist of preparing derivatives having greater water solubility. Zaffaroni and co-workers (*1*) prepared the Girard T derivatives of a large number of steroid ketones, and determined their R_F values on filter paper using a water-butanol partition system. Their procedure, although ingenious, does not give satisfactory separations. Other difficulties involve the instability of the Girard T derivatives and also the inconvenience entailed in their preparation.

A second approach would concern itself with a modification of the partition coefficient in favor of the polar, stationary phase, by incorporating a polar phase other than water in the paper support.

An example of this solution can be found in another method developed by Zaffaroni and co-workers (*2*) for the separation of the more water-soluble adrenal cortical steroids on paper. These investigators impregnated filter paper with either formamide or propylene glycol, which served as the stationary, polar phase, and used benzene or toluene, respectively, as the mobile, nonpolar phase.

A third approach, which has been suggested for the chromatography of compounds whose partition coefficients are greatly in favor of the mobile, nonpolar phase, consists of reversing the two phases. In other words, the supporting substance, paper, silica, kieselguhr, or glass, is treated in such a manner as to hold the nonpolar phase stationary. The more polar phase is then employed as the moving one. Within the past few years a variety of procedures has been described for the production of reversed phase systems and for application of the reversed phase technique (*3–7*).

The partition chromatogram is most effective when the compounds to be separated have R_F values in the range 0.3–0.5. We believed that the application of the reversed phase technique to the problem of separating the less polar steroids would aid in the realization of these conditions.

In this report we wish to present a procedure by which we have been able to separate steroid mixtures by application of reversed phase partition chromatography on filter paper. A paper manufactured in Sweden (Munktell 20, 150 G) was found to be most satisfactory. Strips 8×48 cm were drawn through a 5% (by vol) solution of Dow Corning Silicone No. 1107 in cyclohexane. These strips were then blotted between sheets of an adsorbent paper to remove excess solution and placed in an oven at 110° C for 1 hr. The paper was rendered hydrophobic by this treatment and readily adsorbed vapors of nonpolar substances such as chloroform. The properties of the treated paper are not changed by washing with organic solvents.

The most satisfactory partition system employed for the separation of the group of steroids used was prepared by mixing 6 vol water, 10 vol absolute ethanol, and 10 vol reagent grade chloroform. The two phases separated in a few minutes but were allowed to stand at room temperature for 1 hr before use, the upper phase being the more polar.

Usually 3 mixtures were analyzed on one paper. The 3 mixtures in chloroform solution were applied at 3 different spots at 2-cm intervals along a line 6 cm from one end of the paper. The mixtures to be analyzed contained 10–25 γ of each component. The paper was then placed in an airtight glass cylinder, the atmosphere of which was kept saturated with vapors of the nonpolar phase. After allowing 1 hr for the incorporation of a stationary phase in the paper by adsorption of the vapors, the chromatogram was developed with the more polar alcohol-water phase in the conventional descending manner. When the moving solvent had run the desired distance (35–40 cm) the paper was removed and dried at 110° C for 10–15 min. It was then sprayed with a freshly prepared mixture of equal volumes of a 2% solution of *m*-dinitrobenzene in absolute ethanol and a 2.5 *N* solution of potassium hydroxide in absolute ethanol. In order to achieve maximum development of color, the paper was placed in a 110° oven for 30–60 sec. The distance traveled by a compound was measured from the origin to the center of the spot.

Because of the sensitivity of the R_F values to small differences in the amount of silicone incorporated in the paper, and also because of the many other factors (*8*) which affect the reproducibility of R_F values, we

[1] Aided in part by a grant from the Swedish Natural Science Research Council.

[2] Sloan Foundation fellow, Sept. 1950–Sept. 1951. Present address: Sloan-Kettering Institute for Cancer Research, New York.

TABLE 1

Compound	Relative R_F
Androstanedione 3,17	0.25
Δ^4Androstenedione 3,17	0.385
Androsterone	0.420
Isoandrosterone	0.527
Dehydroisoandrosterone	0.60
Testosterone	0.64

have not attributed great significance to their absolute magnitudes. Instead we have calculated the R_F values of the steroids relative to the slowest moving steroid in our series, androstanedione 3, 17. Since this compound has an average R_F in the neighborhood of 0.25, we have fixed this value as a "standard." Every mixture analyzed contained androstanedione 3, 17. The R_F values of the other components of the mixture were calculated relative to the distance that the "standard" substance had moved. At least 5 different determinations of the relative R_F values were made with each steroid in the series. The average relative R_F values are recorded in Table 1. Variation of the relative R_F values from the average for any one particular compound did not exceed ±4%.

Efforts are now being made to investigate the quantitative aspects of this method.

References

1. Zaffaroni, A., Burton, R., and Keutman, E. *J. Biol. Chem.*, **177**, 109 (1949).
2. ———. *Science*, **111**, 6 (1950).
3. Boscott, R. J. *Nature*, **159**, 342 (1947).
4. Boldingh. *Experientia*, **4**, 270 (1948).
5. Howard, G., and Martin, A. J. P. *Biochem. J.*, **46**, 532 (1950).
6. Partridge, S. M., and Swain, T. *Nature*, **166**, 272 (1950).
7. Kritchevsky, D., and Calvin, M. *J. Am. Chem. Soc.*, **72**, 4330 (1950).
8. Consden, R., Gordon, A., and Martin, A. J. P. *Biochem. J.*, **38**, 224 (1944).

The Alarm Reaction and the Hibernating Gland

Paavo Suomalainen and Anna-Maija Herlevi

Zoological Laboratory,
Helsinki University, Helsinki, Finland

The alarm reaction (*1*) appears, among other things, as an enlargement of the adrenal cortex, rapid increase of the adrenocorticotropic hormone secretion of the pituitary gland and corticosterone secretion of the adrenals, etc. Selye and Timiras (*2*) have found that in rats, coincident with the lipid discharge of the adrenal cortex, reduction in the sudanophile element of the brown fat tissue takes place. The alarm reaction was brought about by keeping piebald female rats in hunger and cold for 16 hr. Reduction in the lipids of the adrenal cortex and peptic ulcer showed that the alarm reaction had really taken place in them.

In animals that hibernate a special adipose tissue, the brown fat tissue, is found, which is called the hibernating gland (*3*). It is a bilateral formation which extends over the neck, axillary region, and anterior part of the back. Its lobes extend to the mediastinum and diaphragm and surround the large blood vessels of the thoracic cavity.

Using the method of Selye and Timiras (from information in a personal communication from P. S. Timiras, Montreal), we have investigated the hibernating gland of the hedgehog (*Erinaceus europaeus*) in the summer (5 animals, July), during hibernation (5 animals, January, after 3 months' sleep), and in animals spontaneously awakened in captivity from hibernation in May (5 animals, killed immediately after awakening). Immediately after killing the animal, the brown fat tissue was fixed in Bouin's fluid for at least 48 hr. After this it was sectioned with a freezing microtome, and the sections stained with Sudan IV and put into glycerol, where they were examined with the microscope.

The hibernating gland was most intensely stained with Sudan in the summer hedgehog; staining was weakest in the just awakened hedgehog. In hibernating hedgehogs the stainability lay approximately halfway between the two extremes. The stronger the stainability, the more sudanophile substance occurs in the hibernating gland.

The size of the sudanophile particles in the hibernating gland was greatest in the summer hedgehog, smallest in the just awakened animal. In the hibernating hedgehog it was again intermediate between the two.

We find that in the hedgehog in hibernation, and especially in the animal awakened from it, one of the phenomena typical of the alarm reaction described by Selye and Timiras has taken place: reduction in number and size of the sudanophile particles in the brown fat tissue. Judging from this, the awakening of the hedgehog from hibernation (*4*) is such a great physiological strain that it induces an alarm reaction.

References

1. Selye, H. *Textbook of Endocrinology*. Montreal: A. W. T. Franks (1947).
2. Selye, H., and Timiras, P. S. *Nature*, **164**, 745 (1949).
3. Rasmussen, A. T. *J. Morphol.*, **38**, 147 (1923).
4. Suomalainen, P. *Sitzber. finn. Akad. Wiss.*, **1943**, 163 (1944).

A Method for Dissection and Electrical Study *in Vitro* of Mammalian Central Nervous Tissue[1]

Donald O. Rudin and George Eisenman

Anesthesia Laboratory, Harvard Medical School,
Massachusetts General Hospital, Boston

Dissection of the spinal cord in the living cat has been found to be a simple and reproducible procedure if the piarachnoid membrane is first carefully re-

[1] This study was made possible by grants from the USPHS, RG 1941, and from the U. S. Army, W-49-007-MD-371 Of No. 323-46.

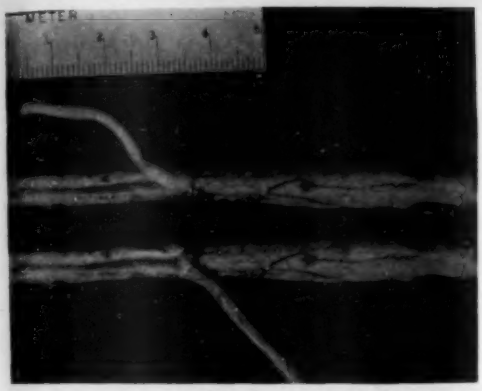


FIG. 1. Dorsal view of lumbosacral cord with cauda equina to the right. Dorsal columns were cleared of pia and dissected in the living cat.

moved. When the resistance offered by this structure is avoided the internal strength of the various white tracts is great enough for them to be peeled away from the remaining cord in lengths of 10–15 cm. Fig. 1 shows the dorsal aspect of a fresh lumbosacral preparation from which the dorsal columns have been partly dissected. The rostral edge of intact piarachnoid can be seen straddling the cord under the 3.5-cm mark. Histological study of a small series of dissected white columns has shown no signs of hemorrhage within them.

Preliminary calculations (based on the formula

FIG. 2. Maximal response of ventral columns *in vitro*. Conduction distance, 6 cm; time signal, 2,000 cps.

presented by Fenn [*1*] and Gerard [*2*] for relating external pO_2 to pO_2 at a depth within tissue of cylindrical form) indicate that oxygenation optimum for the maintenance of the resting metabolism of an individual spinal funiculus can occur by means of diffusion alone if the external pO_2 is in the vicinity of 1.0 atm.

Supporting this theoretical consideration is the fact that well-developed action potentials can be recorded from the tissue *in vitro* for as long as 18 hr. Spike potentials of the ventral columns *in vitro* show a peak amplitude of 15 mv when maintained in 0.88 atm pO_2 and 0.047 atm pCO_2. This can be compared favorably, at least as to order of magnitude, with maximum α-spikes of mammalian peripheral nerve (*3*). In addition, maximum spike velocities up to 114 m/sec and spike durations between 0.4–0.5 m sec have been recorded in the ventral columns. Fig. 2 shows a spike potential that has been rendered monophasic and recorded oscillographically from a ventral column following the application to it of a short rectangular stimulating pulse. This was obtained from tissue equilibrated in a nerve chamber with modified Krebs' solution 4 hr after its dissection. It resembles the directly conducted response of the intact ventral columns *in vivo*. As shown by Lloyd (*4*) and confirmed in this laboratory, the latter is characterized by a single highly synchronized spike showing diminishing amplitude and little tendency to disperse with increasing conduction distance. The form of the *in vitro* spike differs, however, from the *in vivo* response in a manner consistent with volume conductor theory; i.e., the triphasicity is lost. Slow post-spike potentials of low amplitude can also be observed under appropriate conditions of recording but have not yet been studied in detail.

Determination of the physiological state of this tissue and of its optimum artificial environment will require extensive investigation. It is clear, however, that its survival capacity *in vitro* is satisfactory for laboratory study, and some, at least, of its physiological properties remain intact under these conditions.

Not only may central white tissues be manipulated like peripheral nerve for electrophysiological and pharmacological study in a nerve chamber but, as illustrated in Fig. 1, the columns may be only partially separated and left to make normal connection with the rest of the cord at some point. This technique makes possible unusual differential leads for studying input-output relations across central nervous system integrating structures.[2] In certain experimental situations this may be of value in controlling the effects of electrical shunting, field spread, and other phenomena encountered in a volume conductor (*6*).

Fig. 3 demonstrates the type of fractionation of complex potentials that can be carried out by such anatomical means. A shock was applied to L_6 dorsal root entering intact cord. That part of the voltage

[2] It is of interest to note that in 1897 Sherrington (*5*) separated a short length of dorsal column, which he stimulated while observing the ensuing muscle responses.

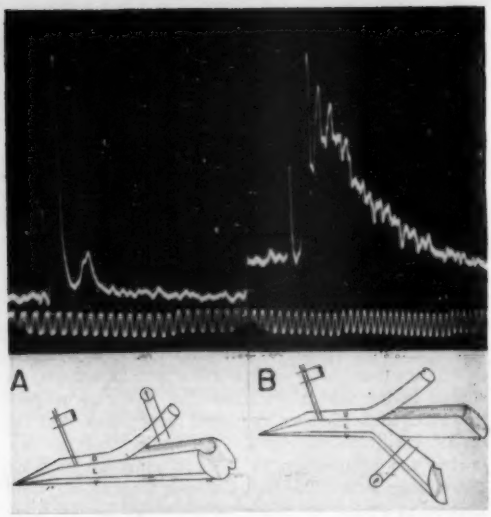


FIG. 3. *A*, dorsal column response to L_6 dorsal root stimulus. *B*, response of ventrolateral column to homolateral L_6 dorsal root stimulus. Stimulus pulse, first negative potential on left. Same preparation and conduction distance as *A*. Cord was split down the midline after the dorsal column had been freed. Time signal, 1,000 cps. Note the absence of triphasicity.

generated by the volley of nerve impulses traveling rostrally in the dorsal columns (dissected down to L_4) can be seen in Fig. 3A. The first spike is analagous to the directly conducted spike of the complex dorsal cord potential described by Gasser and Graham (*7*). The second component disappears more readily on tetanization and lags behind the spike by an amount (2.7 msecs) equal to that of the dorsal column relay potential described by Hursh (*8*). In the undissected cord this potential would be obscured at this level by other potentials arising concurrently in grey matter. Traveling out into the homolateral ventrolateral columns simultaneously with the dorsal column potential is a potential of different character (Fig. 3B). Its spike is delayed by a time interval corresponding to one synaptic delay behind that of the dorsal column spike, as would be expected on the basis of neuroanatomy and as already shown for the intact cord (*9, 10*). The slow negative potential following the spike is a consequence of synaptic activity and has been discussed extensively in the neurophysiological literature. All recordings were taken from stripped tissue with the proximal recording electrode 1.5 cm away from intact cord in order to avoid electrotonic derivatives of its activity. The recording leads have been carried to an RC-coupled preamplifier in such a manner that an upward deflection on the cathode-ray oscilloscope was produced when the electrode nearer intact cord was negative to the distal one.

The details of dissection have been worked out in 40 cats over the past year. The sample records presented here are intended mainly to demonstrate the nature of a method that promises to aid analysis of central nervous system mechanisms by disengaging them along functional and anatomical lines.

References

1. FENN, W. O. *J. Gen. Physiol.*, **10**, 767 (1927).
2. GERARD, R. W. *Am. J. Physiol.*, **82**, 381 (1927).
3. GASSER, H. S. *Ohio J. Sci.*, **41**, 145 (1941).
4. LLOYD, D. P. C. *J. Neurophysiol.*, **4**, 115 (1941).
5. SHERRINGTON, C. S. *Proc. Roy. Soc. (London)*, **61**, 243 (1897).
6. LORENTE DE NO, R. *Studies from the Rockefeller Institute*, **131**, 132 (1947).
7. GASSER, H. S., and GRAHAM, H. T. *Am. J. Physiol.*, **103**, 303 (1933).
8. HURSH, J. B. *J. Neurophysiol.*, **3**, 166 (1940).
9. GRUNDFEST, H., and CAMPBELL, B. *Ibid.*, **5**, 275 (1942).
10. LLOYD, D. P. C., and MCINTYRE, A. K. *Ibid.*, **13**, 39 (1950).

Lewis Evans' Early American Notice of Isostacy

George W. White

Department of Geology, University of Illinois, Urbana

The term "isostacy" was first proposed by Dutton in 1889 (*1, 2*). As early as about 1500 Leonardo da Vinci (*3, 4*) recognized that change of load causes movement of the earth's crust. The earliest recognition in America of what we now call isostatic adjustment appears to have been in 1743 by Lewis Evans, colonial surveyor, cartographer, and geological observer.

Evans was born in Wales about 1700 and died in New York in 1756 (*5*). He is best known for his *Map of the Middle British Colonies* (*6*). He was a keen observer of geologic phenomena and topography and inserted geologic notes on his earlier maps (*7*) and included much more extended geologic notes in *An Analysis of a General Map . . .*, a booklet of 36 pages which accompanied his 1755 map (*8*). Evans' surprisingly modern geological observations, almost completely unnoticed by historians of geology, are now the subject of study, which will be reported more extensively elsewhere.

Evans' remarks on isostacy were recorded in a journal he kept while on an expedition in 1743 from Philadelphia to Onondago and Lake Ontario with John Bartram (*9*), the pioneer botanist, and Conrad Weiser, interpreter and "ambassador" to the Indian tribes. The journal was not published by Evans and is now lost, but a copy was in possession of Thomas Pownall, colonial administrator and patron of Evans, who published parts of it. In 1776 Pownall brought out a revised edition of Evans' 1755 map and *Analysis* (*10*), which he supplemented with his own observations, especially of New England, a territory not well known to Evans. Pownall is careful to indicate exactly the material copied from Evans' *Analysis* and from Evans' 1743 journal. Pownall's original publication is now rare, but a new edition based on Pownall's notes for a revised edition was published in 1949 (*11*).

Pownall, after a discussion of the Appalachian ridges and valleys, in which he mainly quotes Evans' *Analysis*, introduces Evans' unpublished journal observation of 1743 on fossils, the drainage of once

much more extensive Great Lakes, and the consequent effect on crustal elevation and concomitant eustatic movement of sea level. The material on isostacy from Evans' journal is on pages 29 and 30 of the 1776 edition (*10*) and on pages 112–116 of that of 1949 (*11*):

Amidst the Detail of these dry Descriptions, it may perhaps relieve and amuse the Reader to insert some Observations and Opinions which I found in and extracted from Mr. Evans' Journal.

"The Stones in all Parts of these Mountains are full of Sea Shells: . . .

"Various Systems and Theories of the present Earth have been devised in order to account for this Phaenomenon. One System supposes that the Whole of this Continent, the highest Mountains themselves, as they now appear, were formerly but one large Plain, inclining with a considerable Slant towards the Sea; that this has been worn into its present Appearance of Ridges, with Vales between them, by the Rains of the Heavens and Waters of the Earth washing away the Soil from the upper Parts, and carrying it down to Seawards. That the Soil thus carried down and lodged in various Places hath in a Series of Ages formed the lower Plains of the Jerseys, Pennsylvania, Maryland, Virginia, and the Carolinas. . . .

"But we must have recourse to some other Explanation in order to account for the Situation of the Shells on the Tops of the Mountains.

"It is easy to shew the Earth and Sea may assume one another's Places, but positively to assert how that hath actually happened in Times past, is hazardous; we know what an immense Body of Water is contained in the great Lakes at the Top of the Country, and this is a damm'd and held up by Ridges of Rocks: Let us suppose these Ridges broken down by any natural Accident, or that in a long Course of Ages a Passage may be worn through them, the Space occupied by the Water would be drained: This part of America, disburthened of such a Load of Waters, would of course rise, as the immediate Effect of the shifting of the Center of Gravity in the Globe at once or by Degrees, much or little, accordingly as the Operation of such Event had Effect on that Center. . . .

". . . Some such Changes may have come gradually and advanced by such slow Degrees, as that in a Period of a few Ages would not be perceptible; History therefore could take no Notice of them."

Evans recognized the late Pleistocene beach ridges near Lake Ontario as former shore lines of a once more extensive lake, but he assumed also that the fossils in the Paleozoic rocks of the northern Appalachian mountains and Allegheny plateau were remains of forms which once lived in the very much larger body of water which spread to the eastern margin of the mountains. There is some evidence that Evans realized the consolidated Paleozoic rocks were much older that the lacustrine Pleistocene deposits near Lake Ontario. The belief in a great water body extending to the eastern margin of the mountains was held at least until 1818, when Mitchill set forth the idea in great detail (*12*). A few years earlier Volney (*13*) had proposed the same theory. Their source was Evans, but neither followed him in ascribing land uplift to reduction in crustal load.

References

1. Dutton, C. E. *Phil. Soc. Washington*, **11**, 51 (1889).
2. Bowie, W. *Isostacy*. New York: Dutton (1927).
3. Delaney, J. P. *Science*, **91**, 546 (1940).
4. MacCurdy, E. *The Notebooks of Leonardo da Vinci*, 2 vol., New York: Reynal & Hitchcock (1938).
5. Gipson, L. H. *Lewis Evans*. Philadelphia: Historical Society of Pennsylvania (1939).
6. Evans, L. *A General Map of the Middle British Colonies . . .* Philadelphia: (1755).
7. ———. *A Map of Pennsylvania, New Jersey, New York . . .* Philadelphia: (1749, 1752).
8. ———. *An Analysis of a General Map of the Middle British Colonies . . .* Philadelphia: B. Franklin and D. Hall (1755).
9. Bartram, J. *Observations on the Inhabitants, Climate, Soil Rivers . . .* London: J. Whiston and B. White (1751).
10. Pownall, T. *A Topographical Description of such Parts of North America as are Contained in the (annexed) Map of the Middle British Colonies in North America*. London: 1776).
11. ———. In Mulkearn, L. (Ed.), *A Topographical Description of the United States of America (being a revised and enlarged edition)*. Pittsburgh: University of Pittsburgh Press (1949).
12. Mitchill, S. L. *Observation on the Geology of North America . . .* pp. 319–431 of Jameson's translation of Cuvier, *Essay on the Theory of the Earth*. New York: Kirk & Mercein (1818).
13. Volney, C. F. *View of the Climate and Soil of the United States of America . . .* London: (1804).

Liver Cirrhosis with Ascites, Induced in Dogs by Chronic Massive Hepatic Irradiation with Radioactive Colloidal Gold[1]

P. F. Hahn, Marvin A. Jackson, and Horace Goldie

Cancer Research Laboratories, Meharry Medical College, Nashville, Tennessee

In a comprehensive review of the effects of radiation on normal tissue Shields Warren (*1*) has stated that "without much conclusive evidence, it has been assumed that the liver as an organ is relatively resistant to radiation injury." Chronic damage was induced in the liver of the dog by Bolliger and Inglis (*2*) using repeated very high doses (1,800–5,250 r) of unfiltered radiation, fibrosis being noted in some dogs as early as 6 weeks after exposure. In one dog a dense portal fibrosis was observed after 6 months. To the best of our knowledge no instance of extensive cirrhosis associated with ascites has been reported.

Fouts (*3*), as well as McKibbin, Thayer, and Stare (*4*), have shown that it is possible to induce cirrhosis in dogs by prolonged dietary restrictions. McKee and associates (*5*) have briefly summarized the experimental approach to the production of ascites by means of mechanical constriction of the hepatic blood vessels.

We wish to describe briefly a means of producing highly interesting lesions in the dog liver made possible by the relatively high degree of selective uptake by that organ of radioactive colloids of gold which, following intravenous administration, undergo rapid phagocytosis.

[1] This work was carried out under Contract At-(40-1)-269 with the Division of Biology and Medicine, Atomic Energy Commission.

Four littermate mongrel coonhound pups 7 weeks old were used in this experiment. With one animal serving as a control the remaining 3 were given radioactive metallic colloidal gold[2] by vein in increasingly greater quantities, as shown in Table 1. Two weeks later, the only changes of note being a moderate amount of leukopenia, approximately twice the former radiation doses were administered, again by vein. One month later each animal was given another injection of the radioactive gold in quantities approximating 1½ times the previous dose. Blood studies, including the hematocrit and white blood cell count and differential counts, were carried out at approximately 3-day intervals. Dog 50-7, which had received the largest amount of the colloid, developed a marked leukopenia and anemia and about 10 days following the last administration of radioactive material had tarry stools. (Representing an acute radiation injury, this will be discussed at length elsewhere.) Dogs 50-6 and 50-8, although mutually receiving different quantities of the radioactive gold, nevertheless are estimated to have received approximately the same amount of total radiation, using the formula of Marinelli, Quimby, and Hine (*6*), since their body weights were somewhat discrepant. Using the above-mentioned formulas, they received, respectively, an estimated 67,000 and 65,000 equivalent β-roentgen to the liver.[3]

Approximately 6 weeks after the last injection of the colloid, 50-6 and 50-8 showed increasing amounts of ascitic fluid accumulating in the abdominal cavity. Their weights as compared with that of the control are also of interest (Table 1). It is to be noted in addition that both these animals demonstrated a marked retardation in their growth and general appearance. In contrast to the normal control dog, 50-9, which had the appearance of a healthy young hound, the 2 injected animals showed many of the characteristics of young puppies, including the texture of the fur, which was long and silky as compared to the short and tougher texture in that of the control. The results of conventional function and damage tests will be reported in detail later.

Elsewhere we, and others, have discussed the disappearance of radioactive colloidal gold from the circulation of animals following its intravenous administration (*8–10*). Normally the colloid initially disappears from the circulation at a logarithmic rate with respect to time, the concentration reaching half its initial level in several minutes. Tracer quantities of the radioactive gold colloid were administered by vein to the 2 injected animals, as well as the control, and the results can be seen in Fig. 1. The marked differences in the rate of disappearance of the colloid in Dogs 50-8 and 50-6 as compared with the normal 50-9 appeared to be significant, and suggestive of an impaired ability for phagocytosis by the reticuloendothelial system.

[2] Radioactive colloidal gold was produced by n, γ reaction in Oak Ridge pile and processed by D. L. Tabern, of Abbott Research Laboratories.

[3] Doses used in these animals are 20–40 times those used in human therapy. A chronic human leukemia will undergo remission following 2,000–3,000 r to the liver.

TABLE 1

DOSAGE AND SURVIVAL IN ACUTE AND CHRONIC HEPATIC RADIATION

Dog	Age initially (wks)	Dose (mc)		Initial wt (kg)	Est. liver wt (g)*	Est. liver dose β-r	Survival time (days)	Wt at death (kg)
			Acute damage					
50-21	11	54		2.3	55	67,000	9	1.1
50-22	11	74		3.1	75	67,000	9	3.0
50-20	11	39		2.4	57	47,000	15	2.7
			Chronic damage					
50-7	7	20, 38, 44	† 102	3.4	82	85,000	62	3.6
50-6	7	13, 29, 40	† 82	3.5	84	67,000	119‡	6.0
50-8	7	10, 19, 30	† 59	2.6	62	65,000	112‡	4.9
50-9	7	0		3.4	82	0	Alive in good health	9.0 on 2/26§

* Assuming liver represents 2.4% body weight (7).
† Interval between the 1st and the 2nd dose was 2 weeks; between the 2nd and 3rd, one month..
‡ Sacrificed because clinical condition poor.
§ Wt at time of sacrifice of 50–6.

At autopsy about 1,000 ml of clear, slightly yellow fluid was withdrawn from the peritoneal cavity of Dog 50-6 and about 1,800 ml (37% of the body weight) from Dog 50-8. When the abdomen was opened, the liver of the latter (68 g) was barely discernible deep under the rib cage, was markedly atrophic, and of a deep chocolate color. The liver of Dog 50-6 (91 g) had a nodular appearance. In Dog 50-6 there were numerous ecchymotic areas on the skin over the whole body and limbs; the serous surface of the peritoneum showed many hemorrhagic areas; the intestines appeared shrunken and were filled with dark blood. There were no clinical signs of jaundice in any of the animals before death or at autopsy.

The most obvious effects of irradiation in both dogs were disappearance of endothelium and marked increase in connective tissue surrounding the blood vessels. There was proliferation of fibrous tissue in and around the central veins and the portal tracts. Many veins were obliterated (replacement fibrosis), and fibrous bands extended from their thickened walls to anastomose with similar strands from other veins. Branches of connective tissue overgrowth often encircled areas of parenchymatous cells, which latter showed cloudy swelling of varying degrees. Many areas were noted to have what might be considered "ghost vessels." In some obstructed vessels there was evidence of proliferation of endothelial cells. Thus it may be presumed that in other vessels of the same

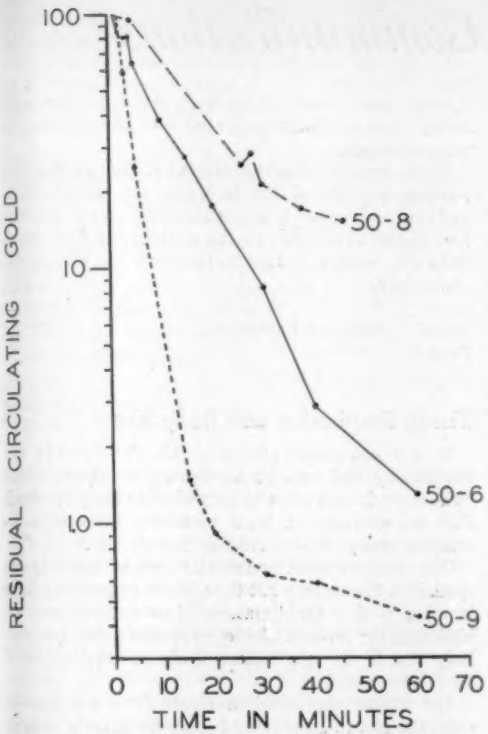


FIG. 1. Disappearance curves of tracer quantities of Au^{198} colloid given intravenously.

liver the initial proliferation of endothelial cells was followed by their disappearance and later by replacement with fibrous tissue. Some areas were almost avascular and showed no regeneration. It seems likely that damage to the liver parenchyma because of irradiation was secondary to impairment of the blood supply.

The outstanding changes in the spleen were the large-scale destruction of lymphocytes and the extensive fibrous tissue proliferation. The Malpighian bodies were hardly identifiable and showed no tendency toward regeneration. The proliferation of fibrous tissue was manifested by thickening and condensation of pre-existing trabeculae and of the capsule.

In Dog 50-22 considerable changes were found in the histological structure of the kidney, many glomeruli having thickened basement membranes. The majority were hyalinized, and the tubular epithelium was swollen.

The pathological changes in the liver induced by massive irradiation (chronic) may be said to resemble a combination of Chiari's syndrome (obliteration of the hepatic veins) and of central fibrosis. Some special features that do not fit into such a definition will be reported at a later date.

In Table 1 are summarized the dosages of gold administered; the estimated liver dose in β-equivalent roentgens, and the time of survival in days. A number of points of interest are apparent on perusal of these data. First of all, Dogs 50-21 and 50-22, although of different weights and having received different total me dosages, have the same estimated β-equivalent dosage delivered to the liver. Their survival time was the same in both cases, namely, 9 days. Dog 50-20 received an estimated 70% of the liver dose given to 50-21 and 50-22 and survived 15 days. Dog 50-7, although receiving a considerably *higher* dose than any of those previously mentioned, nevertheless survived 62 days, presumably because the radioactive material was given in divided doses on 3 occasions, probably allowing sufficient time for some regeneration of hepatic parenchyma to take place before the second and third radiation insults were delivered. Dogs 50-6 and 50-8 again differed considerably in their weights and, although given different total amounts of radioactivity, received an estimated similar dose of β-equivalent roentgens to the liver as the first two animals mentioned. Again the survival time was greatly increased, presumably also because the radiation was administered in divided doses. Both animals died from the severe damage induced by the radiation in the liver and not from the primary radiation effect on the hematopoietic system.

Continuation of this work has shown that age of the animal may play a decisive role in survival. It appears from the above-reported work that the method of radioactive colloidal gold may prove of considerable value where other techniques of experimental liver damage have failed.

References

1. WARREN, S. *Arch. Path.*, **34**, 749 (1942).
2. BOLLIGER, A., and INGLIS, K. *J. Path. Bact.*, **36**, 19 (1933).
3. FOUTS, P. J. *J. Nutrition*, **25**, 217 (1943).
4. MCKIBBIN, J. M., THAYER, S., and STARR, F. J. *J. Lab. Clin. Med.*, **29**, 1109 (1944).
5. MCKEE, F. W., *et al. Surg. Gynecol. and Obstet.*, **89**, 529 (1949).
6. MARINELLI, L. D., QUIMBY, E. H., and HINE, G. J. *Am. J. Roentgenol. Radium Therapy*, **59**, 260 (1948).
7. MORGAN, K. Z. *A Manual of Artificial Radioisotope Therapy*. New York: Academic Press (1951).
8. BARROW, J., TULLIS, J. L., and CHAMBERS, F. W. *U. S. Naval Med. Research Inst.*, Report 24, U. S. Navy Medical Center (1949).
9. SHEPPARD, C. W., WELLS, E. B., and HAHN, P. F. *Am. J. Physiol.*, **164**, 345 (1951).
10. SHEPPARD, C. W., *et al. J. Lab. Clin. Med.*, **32**, 274 (1947).

Comments and Communications

Trenches in Venezuelan Archeology

DURING recent exploration in the Río Negro region in the Territorio Federal Amazonas (Venezuela) the author was advised of the existence, in a place known as *"lugares viejos de los indios,"* of man-made trenches about 300 ft long, 6 ft deep, and 6–9 ft wide. Sherds, some with anthropomorphic decorations, found in the immediate vicinity of these trenches are evidence of former human habitation. In this same zone and, probably, in the same locality or in its immediate vicinity, lanceolate-shaped canoe paddles of hard wood with anthropomorphic decorations on the handle have been found. A wooden implement, decorated with a carved human face, has been found in Caño Loro by Sr. Clemente Calderón of San Carlos de Río Negro and donated by him to Salesian Rev. Father Bombequio, who in turn presented it to the convent of this order in Puerto Ayacucho.

Trenches of this type are reported to be present in many other places, among which are the following: Caserio de Mayagua, Río Pasimoni, Caserio Solano, Caño Pasimoni, Capaco, Caserio Iguaynape, Caño Darigua, Caserio Uraña, Caño Motuiti, Laguna de la Brega, and Caño Bunte, all in Distrito San Carlos de Río Negro. Wooden paddles are said to have been recovered in all these places.

Recently the writer had an opportunity to study one of these trenches in Santa Rosa de Amenodora. Considerably damaged by modern fill from the surfacing of the adjoining village streets, it still retains its ancient morphology and principal characteristics. Starting in the swampy land near the bank of Río Negro, it forms a shallow crescent in the general direction of the village square. Many of the natives remember it when it was unencumbered by recent fill and when its entire length of 210 ft was 9 ft wide and 9 ft deep.

According to popular belief, these trenches were filled with briars or pointed sticks and loosely covered to serve as traps for an attacking enemy. For lack of any evidence that would confirm or refute this belief, the present author advances the hypothesis that these trenches served as hiding places for the Indian dugouts at night or during wartime. These dugouts would not be left in the river because, in the eventuality of an enemy attack, the group that lost its canoes would find itself in a precarious position indeed, in consequence of loss of mobility in forests that, flooded as they are during the greater part of the year, offer very little facility for foot travel.

In the public square of Santa Rosa de Amenodora, a village originally inhabited by the Baré Indians, in a small exposure where erosion has removed the humous horizon of the soil, the author found numerous sherds of archeologic value. One of the local inhabitants declared that the boys of the village had found clay figurines. Indeed, a fragment of such a figurine was presented to the author, but unfortunately it is so badly disfigured that identification is very uncertain.

These trenches deserve careful study, as does the pottery, in view of the fact that the carved canoe paddles and other anthropomorphic wood carvings are, to the knowledge of the author, the first specimens of wooden artifacts recorded in Venezuelan archeology.

J. M. CRUXENT

Museo de Ciencias Naturales
Caracas, Venezuela

Tissue Respiration and Body Size

In a recent paper (*Science*, 113, 593 [1951]) von Bertalanffy and Pirozynski express the opinion that "The experiments seem to be a blow to the hypothesis that the decrease of basal metabolic rates with increasing size is due to cellular factors. . . ."

One wonders what noncellular factors could be responsible. However, what the authors apparently have in mind is that their material does not support the idea that the level of tissue respiration changes with body size to the same extent as the metabolic rate of the whole animal.

The tissues they used originate from one species only, the rat, in sizes from 9 g to 392 g body weight. The metabolic rate in this animal changes approximately according to the usual $M = b\,W^{2/3}$ or $b\,W^{3/4}$. However, if tissues from newborn to adults in one species do not show similar variations, this finding is hardly sufficient for categorically dismissing previous findings of such variations in tissue metabolism in different species. Physiological differences between newborn and adults are too great for use of such material for conclusions concerning the much-disputed "surface law."

The authors refer to Kleiber's review on the subject (*Physiol. Rev.*, 27, 511 [1947]). A careful reader of his chapter on "Intraspecific Comparisons" will find that "only a few species show great enough differences in mature weight for the establishment of the best fitting power function. . . ." Kleiber here refers to total metabolic rate, but the condition of comparing mature animals should also be fulfilled when relating tissue respiration to body size.

The work of von Bertalanffy and Pirozynski is an interesting contribution to the knowledge of differences between mature and immature individuals, and their data on tissue respiration are valuable. In particular, their data on the diaphragm show a considerable decrease in oxygen consumption with increasing body size, which is not properly described by their words: "But it is definitely smaller than the extent postulated by the surface rule. . . ." When plotting their data for this tissue one finds a curve for total

oxygen consumption of the diaphragm versus animal size with a slope of approximately 0.74 (log log scale) —for practical purposes identical with the slope for total oxygen consumption of the animal vs. body size. Field, Belding, and Martin (*J. Cellular Comp. Physiol.*, 14, 143 [1939]) attributed half the tissue oxygen consumption for which they could give an account to muscle. The findings of von Bertalanffy and Pirozynski, therefore, to the extent that comparisons between immature and mature animals are justified, support the view expressed by Krebs (*Biochim. et Biophys. Acta*, 4, 249 [1950]) (who did not publish data on muscle): "The characteristic differences in the basal rate of heat production in animals of different size are to be attributed mainly to variations in the Q_{O_2} of the musculature."

KNUT SCHMIDT-NIELSEN
Kettering Laboratory
University of Cincinnati

The interesting comment by K. Schmidt-Nielsen raises questions that were only touched in our preliminary communication.

The decrease in weight-specific basal metabolic rate, as expressed in the surface, or ¾-power, rule, can be explained in two ways—namely, that it is based upon intrinsic differences of cell respiration in animals of different size which will show up also *in vitro*; or that it is regulated by factors lying in the organism as a whole. Of course, there may be also a combination of both possibilities. If the first alternative is accepted, two hypotheses can further be distinguished; namely, (1) that the decline in weight-specific metabolic rate is based upon a decline of Q_{O_2} in some tissue or tissues, and (2) more specifically, that all tissues show a corresponding and parallel decline in Q_{O_2}, as proposed by Weymouth *et al.* (*Proc. Soc. Exptl. Biol. Med.*, 49, 367 [1942]). Our results, and also those of Krebs, contradict the second hypothesis. As far as the first hypothesis is concerned, we have noticed, of course, that the diaphragm, as the only muscular tissue used in our experiments, shows a remarkable decline of Q_{O_2}, and that this corresponds to Krebs' view that variations in the Q_{O_2} of masculature are responsible for those in basal metabolic rate. Statistical evaluation of our data for diaphragm gives an exponent $a = -.26$, with a high correlation coefficient $r = .93$. Further experiments with skeletal muscles are on our program. A quantitative estimate assuming a decrease in Q_{O_2} similar to that of the diaphragm for total musculature, and attributing, according to Field *et al.*, half of total oxygen consumption to musculature, shows, however, that variations in the Q_{O_2} of musculature cannot be considered as the main factor for the differences of basal metabolic rate within the same species.

We have no prejudice against the "cellular" interpretation. The results favoring it are mentioned in our paper, and our investigation was actually started in the hope of contributing to that view. On the other hand, "organismic" factors are acknowledged, for example, by Kleiber, who points at hormonal and neural regulators, concentrations of ions, nutrients, oxygen, etc., and considers "the analysis of these factors controlling the metabolic level *in vitro* and *in vivo* a most fruitful field for further research" (*Physiol. Rev.*, 27, 523 [1947]).

Our experiments naturally tell nothing about interspecific relations in tissue metabolism, which were studied by Krebs. Though the physiological differences between newborn and adults are great, the same is true for anatomical, physiological, biochemical, ecological, etc., differences even between related species, not to speak of comparisons "from the mouse to the elephant." The striking fact is that in spite of this simple quantitative relations can be established. Our own work is mainly concerned with intraspecific relations in metabolism because it appears that they are basic in the connection between metabolism and growth and the mechanism of the latter (*cf. Am. Naturalist*, 85, 111 [1951]).

LUDWIG VON BERTALANFFY
W. J. PIROZYNSKI
University of Ottawa

Time of Flowering of *Delonix regia*

THE royal poinciana, or "flame tree," *Delonix regia* (Bojer) Raf., called by the Spanish "flamboyant," is endemic in Madagascar, and possibly its poor adjustment to the seasons of the Northern Hemisphere is due to its origin in the Southern Hemisphere. The entire foliage of individual trees sometimes turns yellow, presenting a magnificent spectacle for a few days, like a sugar maple in New England. The feathery leaves, dropped at the same time, cover the ground with an even thicker and more even layer of yellow than the uneven red litter when the blossoms fall. Such trees appear in every other way similar to others near by and quickly have a new crop of leaves. They show no subsequent idiosyncrasy at time of blossoming, but idiosyncrasies are somewhat difficult to detect, for blossoming starts very slowly along the roads of coastal Puerto Rico in mid-May (too late for the tourist season), with most trees in full bloom in June and July, and some straggling on into August and September. Of some two dozen trees planted with seed from a single tree, accidentally selected after the last hurricane of San Ciprián because it was the only one to produce seed, variation in the time and amount of blooming is as great as though no selection had been made.

A trip across the island of Puerto Rico from Río Piedras to Aguirre on May 11, 1951, disclosed conspicuous differences in the amount of flowering of flamboyant. At Río Piedras, where the elevation above sea level is less than 100 ft, the only indication of fresh foliage and blossoming was on a single branch directly underneath a street light. In the hills between Río Piedras and Caguas a few trees had begun to bloom, but it was only in the much higher hills between Caguas and Cayey (elevation 1,233 ft) that

many trees were in bloom. Between Cayey and the pass over the mountains at El Collao (somewhat over 2,000 ft in elevation), practically all flamboyant trees were in full bloom. On the descent to the south coast, again only a few feet above sea level, as on the north coast, the production of foliage and the opening of the flower buds had not begun. Definitely, this was not a reaction to rainfall. After a drought since the first week in December 1950, Río Piedras received much more (8.14 in. for the week ending May 8, 1951) in the last days of April than any other locality of the south coast or in the mountains. Instead, it seems a reaction to elevation and temperature quite the reverse of what is considered normal. Lower temperatures seem to stimulate early blooming instead of causing retardation.

GEORGE N. WOLCOTT
Agricultural Experiment Station
Río Piedras, Puerto Rico

Filing Lantern Slides

THE task of storing and arranging lantern slides in a manner that permits quick and appropriate selection has long been difficult and irksome. Our very workable but not ideal system (not established elsewhere to the best of our knowledge) may be of interest to others who have similar needs.

At present we have more than 2,500 lantern slides in steel files for the use of various members of the Research Department for presentations before the research staff or extramural groups. In order to permit wide use of slides made for several departments it was deemed advisable to keep them all in one place rather than to permit each person to control his own collection.

Our system requires two units—one for the slides, which are kept in numerical order, and the other for reference cards, which are arranged alphabetically according to the topics dealt with on the individual lantern slides. The right-hand side of each 5″ × 8″ card is reserved for an inexpensive photograph, which is made from the negative used to produce the slide; this print occupies not more than one half of the card, leaving the left side for the corresponding number, classification, and interpretation of the slide (Fig. 1). Each slide, as soon as it is made, has a number assigned to it, thus eliminating the cumbersome, inflexible procedure of attempting to keep slides filed by topic.

If taken from a publication, the slide includes the name of the author with the complete bibliographic reference, thereby assuring proper accrediting of the source of information, and enhancing the value of the illustration for reference purposes. Information regarding classification of the card is supplied by the person for whom the slide is made, since presumably he is in the best position to supply it.

As many alphabetically arranged cross-reference

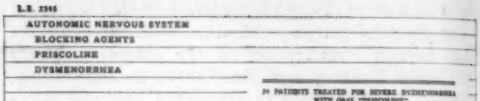

L.S. 2305
AUTONOMIC NERVOUS SYSTEM
BLOCKING AGENTS
PRISCOLINE
DYSMENORRHEA
24 PATIENTS TREATED FOR SEVERE DYSMENORRHEA WITH ORAL "PRISCOLINE"
Griffith, W. I. & Lieth, J. M., South. Med. J. 42: 1092, Dec. 1949

FIG. 1.

cards may be prepared as the subject matter of the individual slides warrants. If one were especially interested in "Blocking Agents" as a lecture topic, for instance, one could thumb through all the cards listed thereunder and, without reading the indexed explanation on the left-hand side of the card in detail, merely glance at the photographs to select desired material. Picking out the particular slides by number is then a simple and rapid operation.

Of further interest is our custom of keeping pertinent information on every lecture given. All this is retained on one 8″ × 11″ sheet filed in a manila folder ("Speeches") according to the date of the presentation. It names the group before which the lecturer appeared and gives the date, the topic, and a complete annotated list of slides employed.

We have found this system of listing and filing lectures convenient for several reasons; namely: (1) it avoids duplication in presenting material before the same group; (2) it assists in the preparation of lectures for new groups, since considerable scientific information can be adapted by the lecturer to various professional and lay groups according to their level of training and interests; (3) it serves as a handy reference, immediately available in one's desk drawer, for bibliographic purposes either in correspondence or in the preparation of manuscripts and reports.

The success of this plan depends upon the cooperation of the secretary in charge of checking out the file cards, the photographer who checks out the lantern slides, and the individual using the materials. As a rule, the cards and slides are returned within 24 hr or less after use so that they may be available to the next individual. Duplicates are made only of those slides that are in frequent demand, so that there may be no delay in scheduled presentations when emergency requests arise.

ROBERT WOLF
LOUISE STEMMLE
FREDERICK F. YONKMAN[1]
Research Department
Ciba Pharmaceutical Products, Inc.
Summit, New Jersey

[1] Lecturer in pharmacology and therapeutics, Columbia University College of Physicians and Surgeons, New York.

Book Reviews

Plant Growth Substances. Folke Skoog, Ed. Madison: Univ. Wisconsin Press, 1951. 476 pp. $6.00.

During the centennial celebration of the founding of the University of Wisconsin in 1949 two important plant science conferences were held. The present volume contains 39 papers presented in general meetings and round-table discussions of one of these. This symposium was attended and participated in by a good portion of the world's foremost students of growth substances.

The scope of the book is much broader than that of any other in its field and shows how rapid has been the increase of knowledge and its application during the quarter century since the general acceptance of the concept of plant hormones as correlating agents. As is well shown, interest in plant-growth substances has developed from a simple laboratory curiosity to numerous very practical applications upon which a multimillion-dollar agricultural chemicals industry is now based. In addition, while sifting the thousands of papers that have appeared, the authors show that a good hard core of information of theoretical value useful in interpreting growth reactions is now available.

Because of the many ramifications of the field and the large number of papers included here, certain organizational difficulties had to be solved. Dr. Skoog has met this editorial problem very well. The book is divided into 7 major sections: a general discussion of plant growth substances, "Growth Substances in Plant Metabolism," "Tissue Response to Growth Substances," "Practical Applications of Growth Regulators," "Growth Substances in Vegetative Development," "Growth Substances in Reproductive Development," "Growth Substances in Pathological Growth," and "Vitamins and Amino Acids as Growth Factors." Although this is a logical and satisfactory arrangement, some readers may find fault with the placement of certain papers and even whole sections. Some may wish, for example, that the excellent survey of the development of ideas in the field of growth substances given by Went had been used as the opening instead of the sixth chapter. Others may think, because of structural make-up, that greater continuity could have been achieved if the section on "Growth Substances in Vegetative Development" had followed the one on "Growth Substances in Reproductive Development."

On the whole the chapters represent a distillate of clear thinking. Inevitably, however, there is unevenness in scholarship, some of the papers being more painstakingly done than others. Much of the book retains the flavor of spoken presentation, which tends to give vitality, spontaneity, and freedom from stilted and involved language. In a few instances contributors revised their talks very little for publication, and some failed to document their papers at all. In several cases citations are incorrect, and occasionally papers are cited that do not appear in the individual bibliographies. Those who wish to use this as a reference book will be disappointed at the omission of an index. This is sure to result in less use than the book deserves.

Among the stimulating features of the symposium is the clear expression of differences in viewpoint that might be missed in a book written by a single author. In a field still in a state of flux, this method of treatment is very desirable. Owing to Dr. Skoog's careful editing, repetition is at a minimum, and what does occur neither detracts from nor weakens the text.

In several chapters new and previously unpublished material is presented. For example, R. H. Roberts' chapter, "The Induction of Flowering with a Plant Extract," is wholly new. Those interested in the physiology of flowering will look forward to confirmatory reports on the purification of the six "florigens" said to have been crystallized.

Valuable as some of the new information is, many will find the numerous suggestions of lines along which future investigations can profitably proceed of even greater importance. Certainly, numerous graduate students, as well as others, will find abundant inspiration here. All those interested in having a well-rounded and balanced presentation of information on growth substances, together with some speculation about things to come, will find it worth while to own and use this book.

AUBREY W. NAYLOR

Osborn Botanical Laboratory
Yale University

L'Evolution Biologique: Les Faits, Les Incertitudes. Lucien Cuénot, with collaboration of Andrée Tétry. Paris: Masson et Cie, 1951. 592 pp. 2,500 fr.

This last work of the late Professor Cuénot is a document of his amazing mastery of biological facts, his love for out-of-the-way information, and his great erudition in history and philosophy. The major part—actually 529 pages—contains an orderly and well-organized catalogue of facts pertaining to the study of evolution, both in animals and in plants. This section will be especially useful to the writer on, or the teacher of, evolution who looks for examples to illustrate definite points. He will find not only much material pertaining to practically every aspect of evolution but also many gems of forgotten information. The author predominantly reviews the facts of ecology and physiology that pertain to adaptation, selection, fertility, and survival. He emphasizes, of course, phenomena especially studied by him—such as the complicated tool-like organs (e.g., pedicellaria), the asymmetrical structures of crustacea, and the facts that have been used in discussions of the so-called heredity of acquired characters.

It is not quite clear why this very remarkable catalogue of adaptations, cases of selection, facts concerning the consequences of change of environment, etc.,

also includes a condensed review of elementary genetics and cytogenetics, as well as long chapters on nonhereditary variation. The explanation may be inferred from the last chapter. Here the author, although fully aware of the genetical study of evolution and its results, confesses rather cautiously, reiterating that most evolutionists will not follow him, that he is not satisfied with modern evolutionary ideas. He still thinks that a modified kind of doctrine of inheritance of acquired characters of the type proposed by Baldwin and Schmalhausen will be needed, and he feels the additional need, expressed in a noble spirit of self-criticism, for a finalistic philosophy in order to understand evolution.

In these days of standardization of scientific ideas it is wholesome to listen, at least occasionally, to different views if presented so well by a first-rate scholar.

RICHARD GOLDSCHMIDT

Department of Zoology
University of California, Berkeley

Selected Topics in X-Ray Crystallography from the Delft X-Ray Institutes. J. Bouman, Ed. Amsterdam: North-Holland Pub.; New York: Interscience, 1951. 375 pp. $11.00.

The Delft X-Ray Institutes, located at the Technical University of Delft, comprise three x-ray laboratories with a total of 62 years of experience in fundamental research and in the application of x-ray structure determination to metallography, biology, and rubber. Although each laboratory has its own special interests, results are mutually exchanged, and this cooperation is clearly reflected in the present publication, which consists principally of reports of research carried out during the past decade. The subject matter is divided into a series of eight interrelated monographs, each of which is complete in itself. Credit for authorship goes chiefly to J. Bouman, but many others, including W. G. Burgers, J. M. Goppel, and J. A. Prins, have contributed major sections.

The volume is primarily concerned with the study of materials in which deviations from the ideal lattice structure occur, rather than with the direct investigation of crystal structure. Nevertheless, Part A is devoted to the latter problem and briefly discusses pertinent points, such as termination effects in Fourier syntheses and the increase in breadth of Debye-Scherrer lines produced by small crystal particle size. The subject of lattice distortions is first approached by a study of the results of metallographic investigations (Parts B and C), and a general theory is presented to explain the decrease of intensity and broadening of the lines in powder films. Macromolecular substances with lattice deviations, such as rubber, waxes, and starch, are examined in Parts G and H, where new data is presented to discount Fields' original work on rubber. Controversial problems still persist in these two fields, and satisfactory correlation between the results from different methods are difficult to obtain. Part H, on biological compounds, contains a well-detailed account of a micromethod for x-ray diffraction.

Applications of chemical interest are included in Part D, dealing with the photographic process, and in Part F, where an exhaustive account of quantitative analysis by x-rays is given. Part E, concerned with problems relating to liquids, glasses, and amorphous substances, is the most readable section, probably because of the fine sense of humor portrayed by the author.

Because of the wide diversity of topics presented, each monograph is necessarily concise, but nevertheless surprisingly complete—as a critical survey of contemporary developments is generally included along with a number of well-chosen references for those who wish to pursue the subject further. Although much of the material has been published previously, it was in various European journals not readily accessible during the war. This is corrected in the present volume. In addition, later data and new aspects have been included, particularly in the sections on the investigations of rubber and biological compounds.

Being a first edition, the book contains a number of misprints and notations that are inadequately defined. There are also spellings and abbreviations that will be unfamiliar to the American reader. This is not surprising for a book printed in the Netherlands. Nevertheless, these do not impair the usefulness of the volume to those who wish to broaden their concepts and increase their knowledge of the applications of x-ray techniques. This comprehensive book will add to the fame of the Delft X-Ray Institutes.

W. P. BINNIE

Department of Physics, Purdue University

Scientific Book Register

Organic Reactions, Vol. VI. Roger Adams, Ed. New York: Wiley; London: Chapman & Hall, 1951. 517 pp. $8.00.

Introduction to the Theory of Algebraic Functions of One Variable. Claude Chevalley. New York: American Mathematical Society, 1951. 188 pp. $4.00.

Sexual Behavior in Penguins. L. E. Richdale. Lawrence: Univ. Kansas Press, 1951. 316 pp. $5.00.

Radioisotopes: Industrial Applications. G. H. Guest. New York–London: Pitman, 1951. 185 pp. $4.50.

Practice of Wildlife Conservation. Leonard W. Wing. New York: Wiley; London: Chapman & Hall, 1951. 412 pp. $5.50.

Annual Review of Medicine, Vol. 2. Windsor C. Cutting, Ed. Stanford, Calif.: Annual Reviews, 1951. 485 pp. $6.00.

Studies in Oenothera Cytogenetics and Phylogeny. Ralph E. Cleland, Ed. Bloomington, Ind.: Indiana Univ. Pubs., 1950. 348 pp. $4.00.

Musical Acoustics. 3rd ed. Charles A. Culver. Philadelphia: Blakiston, 1951. 215 pp. $4.25.

A Concise History of Astronomy. Peter Doig. New York: Philosophical Library, 1951. 320 pp. $4.75.

Ferromagnétisme et Antiferromagnétisme. Colloques Internationaux du Centre National de la Recherche Scientifique, Vol. XXVII. Paris: Service des Publications, C. N. R. S., 1951. 360 pp.

News and Notes

Scientists in the News

Arnold Kent Balls, head of the Enzyme Division, USDA Western Regional Research Laboratory, Albany, Calif., has accepted a position as professor of enzyme chemistry at Purdue. Dr. Balls has been employed in the Bureau of Agricultural and Industrial Chemistry for about 22 years.

Willard W. Beatty, chief of the educational program of the Bureau of Indian Affairs for the past 15 years, has been appointed deputy director of the Department of Education, in charge of fundamental education training centers for Unesco.

Bruce H. Billings, director of research at Baird Associates, Cambridge, Mass., is visiting laboratories in Europe and will give a series of lectures at the Technische Hogeschool in Delft.

Tze-Tuan Chen has been promoted from associate professor to professor of zoology at the University of Southern California.

Richard Donovick has been appointed director of the Division of Microbiology in the New Brunswick, N. J., Research and Development Laboratories of E. R. Squibb & Sons.

Leonard P. Eliel, formerly associate at the Sloan-Kettering Institute, Memorial Hospital Cancer Center, and assistant professor in the Department of Medicine of Cornell Medical College, has been appointed as a member of the staff of the Oklahoma Medical Research Institute and Hospital, Oklahoma City. He will be head of the Section on Clinical Oncology and associate professor of research medicine at the University of Oklahoma School of Medicine, with which the institute and hospital are affiliated. Another addition to the institute and hospital staff is **Robert Howard Furman,** formerly assistant professor of medicine at Vanderbilt University School of Medicine and assistant visiting physician of the University Hospital. Dr. Furman will be head of the Section on Cardiovascular Disorders and will have an appointment as associate professor of research medicine.

Arnold Feldman, formerly of Mayo Clinic, has been appointed an instructor in radiological physics in the Department of Radiology, University of Colorado School of Medicine.

Kenneth E. Fields has been appointed director of the Division of Military Application of the U. S. Atomic Energy Commission, succeeding **James McCormack, Jr.,** who has been assigned as a special assistant to the deputy chief of staff for development, in USAF headquarters. Colonel Fields has served as assistant to the commanding general, Manhattan Project, and assistant to the director of military application for the AEC. General McCormack served as director of the Division of Military Application continuously from February 1, 1947. He was the first director of the division, who, under the Atomic Energy Act of 1946, must be a member of the armed forces.

The new director of the Swedish Jernkontoret is **Sven Fornander.** He replaces **M. Tigerschiold,** who has taken an industrial position at the Grangesberg-Luossavaara-Kiirunavaara Co.

Charles L. Fox, Jr., has been appointed research associate in surgery with professorial rank at New York Medical College, Flower–Fifth Avenue Hospital. New laboratories have been built at the hospital for research he is doing with **James M. Winfield** on electrolyte metabolism and improved methods of treating shock caused by burns and other trauma, under a grant from the USPHS. Dr. Fox was formerly assistant professor of bacteriology at the College of Physicians and Surgeons, Columbia University.

Harry V. Gilson, associate commissioner of education for the state of New York, has been appointed director of education of the National Society for Crippled Children and Adults. Other new staff appointments include **Mary F. Pollard,** who has been with the New Mexico Department of Health, and who will serve as consultant in community organization and health education; and **Irene K. Rowland,** of Streator, Ill., who will assist in interpreting the service program for crippled children to the general public and to volunteer workers throughout the country.

W. C. Gorham has been appointed professor and head of the Department of Biology at Albany College of Pharmacy, Union University, succeeding **Raymond A. Dobbins,** deceased.

Frank Harrison, chief of the Division of Anatomy at the University of Tennessee Medical Units in Memphis, has resigned. He will be succeeded by **Roland H. Alden,** now head of the Department of Microscopic Anatomy. Dr. Harrison will continue as professor of anatomy until December, when he will join the faculty of Southwestern Medical School of the University of Texas at Dallas, as professor, teaching and doing research in neuroanatomy.

A. L. Hodson, of the cosmic ray research staff of the University of Manchester, will spend the coming year at Princeton University. **D. H. Wilkinson,** of the Cavendish Laboratory, Cambridge, is at Cornell, where he will be concerned with interpretation of his experiments on photonuclear reactions. **C. Peyrou,** of the cosmic ray group of Leprince-Ringuet, Ecole Polytechnique, Paris, is planning to spend the coming year at MIT, where he will continue cosmic ray research.

Axel Hultgven is retiring this year as head of the Division of Metallography, Royal Technical University, Stockholm.

P. C. Jones is now editor of the *Bell System Technical Journal*. He became associate editor on the retirement of **R. W. King** in the fall of 1949, and has been acting editor since the retirement of **J. O. Perrine** in February of this year. He will continue as science editor of the *Record*.

A South African expert, **Raimund Marloth,** has been selected by FAO to advise Yugoslavia on subtropical fruit growing. Dr. Marloth is director of the Nelspruit Subtropical Horticultural Research Station, Union of South Africa.

K. E. W. Penzhorn, chief professional officer of the Division of Soil Conservation and Extension for the Transvaal and Orange Free State Highveld, has been invited by the State Department to undertake a study tour through the U. S. He will visit experimental stations and will obtain firsthand knowledge of the use of hybrid corn.

Milton S. Plesset, professor of applied mechanics, and **W. Ducan Rannie,** associate professor of mechanical engineering, at Caltech, have been named by Hoyt S. Vandenberg to serve as members of his Scientific Advisory Board during the coming year. Dr. Plesset will be a member of the new Panel on Physical Sciences, and Dr. Rannie, of the Panel on Fuels and Propulsion.

A. C. Ritchie, Oxford University, has arrived in this country to do research and teach as a visiting member of the faculty of the Chicago Medical School. He will work in the Laboratory of Cancer Research under the direction of Philippe Shubik, assistant professor of surgery and coordinator of the Cancer Teaching Program.

After serving several years as leader of American Petroleum Institute Research Project 43A at the Scripps Institution, **Frederick D. Sisler** has moved to Edgewood, Md., to take a position as assistant chief, Biological Section, Research Branch, U. S. Army Chemical Corps.

The American-Scandinavian Foundation, with the American Labor Education Service, is sponsoring a visit to Denmark and Sweden of **Maida S. Springer,** an executive of Local 22 of the International Ladies Garment Workers Union, to study trade union methods. This is the third year in which American trade unionists have visited Scandinavia under the foundation's sponsorship.

In June **Oswald Tippo,** Department of Botany, University of Illinois, became editor-in-chief of *The American Journal of Botany,* succeeding **Bernard S. Meyer,** Department of Botany, Ohio State University, who had held this position for more than five years.

Edward Raymond Tompkins has been made acting head of the Chemical Technology Division of the U. S. Naval Radiological Defense Laboratory, San Francisco. Dr Tompkins' work has been concentrated on methods of separating and purifying radioisotopes.

Hugh L. Turrittin, associate professor of mathematics and mechanics, has returned to the University of Minnesota, after spending a sabbatical year on the staff of Princeton University.

William G. Van Note, a member of the faculty of North Carolina State College for 18 years, has been appointed president of Clarkson College of Technology at Potsdam, N. Y. He succeeds **Jesse H. Davis,** who will become president of Stevens Institute of Technology. Since 1946, Dr. Van Note has been director of the Department of Engineering Research and professor of metallurgy at North Carolina State.

The Electrochemical Society has announced that the first Palladium Medal Award will be presented to **Carl Wagner,** visiting professor of metallurgy at MIT. The Palladium Medal was established in 1950 by the Corrosion Division of the society, for outstanding contributions to corrosion and to fundamental electrochemistry. The award is made possible by royalties received from sales of the *Corrosion Handbook*. Dr. Wagner will receive the medal at the October meeting of the society in Detroit, when he will present the medal award lecture covering certain phases of his research. He has been at MIT since 1949.

Walter A. Wood, head of the Arctic Institute's ice studies project on Mount Hubbard, and three other members of his party have been picked up from a glacier on Mount Hubbard by a ski-equipped Air Force plane. The explorer's wife and daughter and the pilot of the supply plane have been missing since July 27.

Education

Robert Williams Graves, professor of neurology at **Albany Medical College,** has been appointed director of the newly created Department of Neurology and chief of the Neurological Service at Albany Hospital. Frederick H. Hesser, formerly assistant professor of neurology at the State University of Iowa, has been appointed associate professor of neurology and attending neurologist at the hospital. Samuel Tarnower has been promoted from associate in neurology to assistant professor of neurology. Gordon W. Searle and Lucile Williams have joined the staff of the Department of Physiology and Pharmacology. Dr. Searle was formerly at the Northwestern University School of Medicine, and Dr. Williams at Creighton University School of Medicine.

Bar-Ilan University, which is expected to open in 1953 with a two-year college course, has received a grant of 30 acres of land in a Tel Aviv suburb from the Mizrachi Organization of America, sponsors of the $5,000,000 project. Emphasis will be on applied sciences, although the school will have a religious atmosphere and a large part of the curriculum will be devoted to religious subjects.

The **Books for Freedom** campaign, designed to col-

lect from voluntary sources 100,000 scientific, social service, medical, legal, and engineering textbooks for the Free University of Berlin, reports that 100 U. S. colleges have pledged books. The University of Pennsylvania alone has contributed 600 books in history and economics.

The **University of California** at Los Angeles has appointed Harvey Winston (Berkeley) assistant professor of chemistry, and Allen L. McCloskey (Wisconsin) instructor. Promotions in the Department of Chemistry include Thomas L. Jacobs and James D. McCullough to professor, Donald J. Cram to associate professor, and Paul S. Farrington to assistant professor.

Studies in nuclear engineering at **Columbia University** will be expanded this year to include three courses: an introduction to reactor technology, a cooperative course, with lecturers from the Engineering, Pure Science, and Medicine faculties; instruction in the process design of atomic piles and associated chemical processing of products and wastes; and the industrial use of atomic energy.

Cornell University will establish, in its School of Chemical and Metallurgical Engineering, a laboratory devoted specifically to rubber and plastics. William C. Geer, former director of research for the B. F. Goodrich Co., but best known for his invention of the airplane de-icer, has provided equipment and funds for the laboratory, which will be devoted mainly to research on synthetic rubber. C. C. Winding will be in charge.

Duke University will be the headquarters for a nation-wide basic research program sponsored by the Ordnance Corps. Marcus E. Hobbs, of the Department of Chemistry, is acting chief scientist, and W. W. Holler will be in command of the establishment, which is to be known as the Office of Ordnance Research. The office will evaluate projects and award contracts with the aid of scientists from the Ordnance Corps.

Michael Kasha, who studied at the University of Manchester as a Guggenheim fellow last year and lectured in France and Italy, has been appointed professor of physical chemistry in the Department of Chemistry at **Florida State University.** He will assist in the establishment of a new molecular spectroscopy laboratory at the University.

Harvard University, through its Russian Research Center, has undertaken a study of the Russian people and the Soviet social system. The four-year Harvard Refugee Interview Project is under the over-all direction of Clyde Kluckhohn, and is based on interviews with people who have left Russia for various reasons. More than 3,000 persons have been interviewed. Raymond A. Bauer was field director of the European operations, in which 20 American social scientists participated. The work is being done under contract with the Human Resources Research Institute, of Montgomery, Ala.

Moreno Institute, formerly the Sociometric Institute, has received a provisional charter from the Board of Regents, New York State. It specializes in the training of group psychotherapists, psychodramatists, and sociometrists. Under its auspices an International Committee of Group Psychotherapy has recently been formed. The first International Congress of Group Psychotherapy is planned for the autumn of 1952. For further information write to the Moreno Institute, P. O. Box 311, Beacon, N. Y.

Princeton has increased the space in its plastics laboratory by 50 per cent with the completion of a new wing, which is expected to be fully equipped for operation by the opening of the school year in September. The university does research in polymer science for the Army, Navy, and Air Force and is investigating the mechanical and electrical properties of solids.

Grants and Fellowships

The **American Chemical Society** announced the following awards at its diamond jubilee meeting in New York: Harrison S. Brown, the ACS Award in Pure Chemistry, $1,000 and a diploma; Joel H. Hildebrand, the $1,000 Scientific Apparatus Makers Award in Chemical Education; Yves Rene Naves, Geneva, Fritzsche Award of $1,000 and gold medal for achievement in the field of essential oils; Carrell H. Whitnah, the $1,000 Borden Award in the chemistry of milk; David M. Bonner, the Eli Lilly Award, $1,000 and a gold medal for achievement in biological chemistry; Vladimir Haensel, the $1,000 Precision Scientific Company Award in petroleum chemistry; Bernard L. Horecker, the $1,000 Paul-Lewis Laboratories Award in enzyme chemistry; Melvin Guy Mellon, the $1,000 Fisher Award in analytical chemistry; and Gladys A. Emerson, the ACS Garvan Medal for 1952. Arthur B. Lamb, professor emeritus of chemistry at Harvard, received an honorary fellowship in the Chemical Society of London.

Financed by a grant of $31,616 from the **Rockefeller Foundation,** the American Council on Education has begun an exploratory research project on the relation of religion to public education. Clarence Linton, on leave from Teachers College, will direct the project.

Guggenheim Memorial Foundation fellowships in the amount of $90,000 awarded last month went to 30 scholars and artists from Latin-American countries and the Philippines for research and creative work. The awards bring the total number of fellowships awarded in 1951 to 184 and the total of stipends to $658,000. The medical sciences received the largest number of awards, with botany and geology and geography next. Alexander Wetmore was chairman of the award committee.

Hematology Research Foundation has awarded the Ruth Berger Reader Fellowship to Abe Oyamada at Mount Sinai Hospital, Chicago, for the second year, and the Robert L. Goldblatt Fellowship to Arthur A.

Billings at Michael Reese Hospital, Chicago. Grants for research in diseases of the blood were made to Steven O. Schwartz, Cook County Hospital; Karl Singer, Michael Reese Hospital; Allen H. Minor, Lenox Hill Hospital; and George J. Andy, Loyola Medical School. The foundation also furnishes the basic support for the Hematology Research Laboratory at Michael Reese.

Applications for 1952 grants-in-aid of research on cardiovascular problems will be received by the **Life Insurance Medical Research Fund**, 2 E. 103rd St., New York City 29, up to *Nov. 15*. Support is available for physiological, biochemical, and other basic research, as well as for clinical investigations in the field. The annual stipend is between $3,000 and $4,000, and an M.D. or Ph.D. or the equivalent is required. A few predoctoral fellowships will also be awarded. For details address the Scientific Director.

In the Laboratories

Battelle International, a new research institute to be established in Europe this fall, will maintain laboratories and offices in several Western European countries. Launched by Battelle Institute, the program will be financed primarily by Battelle funds and American industrial sponsors. John S. Crout, B. D. Thomas, and W. R. Keagy, of the American Battelle, are in Europe to complete negotiations for laboratory sites and to recruit a European staff. It is also proposed to begin projects at the Fulmer Research Institute, TNO Council, and the Max Planck Gesellschaft. An important part of the program will be an exchange of scientists between American and European laboratories.

Chemstrand Corporation has named Carol O. Hoyer, of the Plastics Division of the Monsanto Chemical Company, Springfield, Mass., director of its general Engineering Department.

Franklin Institute Laboratories for Research and Development have established a new Applied Hydraulics Section in the Mechanical Engineering Group. Current work consists of the application of pivoted-shoe oil-film bearings to improve the performance of hydraulic transmissions, testing of a special-purpose compressor of new design, and development of pivoted-shoe thrust bearings which use unconventional lubricants for special-purpose machinery.

Horizons Incorporated has appointed John T. Burwell, Jr., formerly of the MIT Mechanical Engineering Department, as assistant to the director of research. He will make his headquarters at the company's laboratory in Cleveland. **Horizons Titanium Corporation** has named Irvin R. Kramer, of NRL and ONR, assistant to the president. His office will be in Washington, D. C., where he will work on the development of the process involving the extraction of titanium, developed by Horizons Incorporated in conjunction with the Navy and ONR.

International Refineries, Inc., of Minneapolis, will construct a $7,000,000 oil refinery near Duluth. The required crude oil will be brought from Alberta through the facilities of the Interprovincial Pipe Line Company. Completion of the plant is expected by 1952.

Leeds & Northrup Company has appointed Raymond C. Machler director of research, succeeding I. Melville Stein (SCIENCE, 114, 225 [1951]). J. C. Peters, associate director of research, will be joined in that capacity by G. A. Perley and A. J. Williams, Jr.

Meetings and Elections

The **American Council on Education** is holding a Conference on Women in the Defense Decade at the Hotel Commodore, New York City, Sept. 27–28. More than 600 official delegates have been appointed by educational institutions and organizations. Among the speakers will be Arthur S. Adams, Louis Baur, Oliver C. Carmichael, Margaret D. Craighill, Lena E. Eberling, Erwin Edman, Norma Farrar, Althea Hottell, Mary F. Langmuir, Eduard C. Lindeman, Anna M. Rosenberg, and Pauline Park Wilson.

The **American Library Association** installed Loleta D. Fayn as president at the close of its 75th anniversary conference. Robert Bingham Downs, director of the University of Illinois Library School, was chosen first 1951–52 vice president (president-elect) and Marian McFadden, second vice president. R. Russell Munn was re-elected treasurer. At the same meeting the 1950 Lippincott Award was presented to Helen E. Haines "in recognition of outstanding librarianship." Miss Haines teaches at USC Library School and at the Columbia University summer sessions.

A **Canadian Association of Geographers** was organized last May at McGill University by a group of more than 50 geographers from all parts of Canada. D. F. Putnam, of the University of Toronto, was chosen president, and Pierre Dagenais and J. Lewis Robinson, vice presidents. Pierre Camu was elected secretary-treasurer.

A **Conference on the Chemistry and Physics of Polymers and Colloids** will be held at Wayne University on Sept. 27, sponsored by the College of Liberal Arts in cooperation with several local and national industries. Speakers will be O. Kratky, University of Graz; J. J. Hermans, University of Groningen; E. J. W. Verway, Philips Research Laboratories, Eindhoven; J. Th. Overbeek, University of Utrecht; and G. G. Overberger and H. Mark, Institute of Polymer Research, Brooklyn.

Kessler Institute for Rehabilitation will hold its free semiannual clinic for congenital amputees on Oct. 17. This year the clinic will emphasize the genetic origin of congenital defects, and it is planned to have several leading geneticists take part. The clinics feature group conferences with parents. Persons who wish to attend should write to Mrs. Noel Dousman, Kessler Institute, Pleasant Valley Way, West Orange, N. J.

PHASE MICROSCOPY

By ALVA BENNETT, HELEN JUPNIK, HAROLD OSTERBERG, and OSCAR W. RICHARDS, all with *American Optical Company*. This new book combines the work of four scientists who have made outstanding contributions to the theory, instrumentation, and application of the phase microscope. It describes phase microscopy fully, including principles, operation, adjustments, use, and various applications. *1951. 320 pages. $7.50.*

FUNDAMENTAL PRINCIPLES OF POLYMERIZATION

By G. F. D'ALELIO, *Koppers Company*. Gives a comprehensive picture of the entire field, including an outline of basic processes. Dr. D'Alelio classifies polymers according to the rubber, the plastic, and the fiber states and concentrates on the facts and fundamentals with which anyone interested in polymers should be familiar. *1951. Approx. 477 pages. Prob. $6.00.*

STATISTICAL METHODS FOR CHEMISTS

By W. J. YOUDEN, *National Bureau of Standards*. Characterized by an absence of statistical theory and proofs, this book presents the modern system of units for expressing scientific conclusions. Written from the laboratory man's viewpoint, it describes techniques useful in a wide variety of scientific investigations. *1951. 126 pages. $3.00.*

ORGANIC SYNTHESES, VOLUME 31

Edited by R. S. SCHREIBER, *Upjohn Company*. The latest of these volumes contains 40 new syntheses. For almost 30 years these books have been reliable guides to convenient, pretested laboratory methods for preparing various organic chemical reagents in one-half to five-pound lots. Each method can be adapted to large scale development. *1951. 122 pages. $2.75.*

AN INTRODUCTION TO ELECTRON OPTICS

By L. JACOB, *University of Liverpool*. Presents the principal laws involved in considering motion of charged particles through electric and magnetic fields. The character of the focusing and deflection effects are treated in some detail and some of the simpler applications are described. This is one of the METHUEN MONOGRAPHS ON PHYSICAL SUBJECTS. *1951. 150 pages. $2.00.*

THEORY OF PERFECTLY PLASTIC SOLIDS

By WILLIAM PRAGER, *Brown University* and PHILIP G. HODGE, *University of California, Los Angeles*. The first book to present an intermediate treatment of the mathematical theory of perfectly plastic solids. The book includes important findings in limit analysis, results which shed new light on relations between theories of v. Mises and Prandtl-Reuss. *1951. 264 pages. $5.50.*

Send now for on-approval copies.

JOHN WILEY & SONS, INC. 440 Fourth Avenue, New York 16, N. Y.

REGISTER NOW

for the Philadelphia Meeting of the AAAS

AVOID CONGESTION AND DELAY
GET YOUR GENERAL PROGRAM –
BY FIRST CLASS MAIL – EARLY IN DECEMBER

Registration in *advance* of arrival at the 118th Annual Meeting of the AAAS in Philadelphia, December 26–31, 1951, has several striking advantages:

1. You avoid congestion and delay at Registration Desks at time of arrival. All indications point to a large attendance since all of the Association's eighteen sections and subsections, and more than forty societies, have excellent programs, and, in addition to paper-reading sessions, there will be the important symposia, conferences, and addresses for which an AAAS Meeting is noted.
2. You receive the General Program early in December in ample time, unhurriedly, to decide among the events and the sessions that you particularly wish to attend.
3. Your name will be in the Visible Directory the first hour of the first day of the meetings, since it will be posted in Washington as soon as received. (Hotel address can be added later, if necessary.)
4. Advance Registrants have the same privileges of receiving a map and directory of points of interest in Philadelphia, literature, radio broadcast tickets, etc. At the convenience of Advance Registrants, these will be distributed from the Main Registration in the Municipal Auditorium—the location of the full-scale Annual Exposition of Science and Industry, the Visible Directory, the AAAS Science Theatre, and the Biologists' Smoker.

To insure its prompt receipt, the General Program will be sent *by first class mail* December 1–6, 1951—which last is also the closing date for Advance Registration.

THIS IS YOUR ADVANCE REGISTRATION COUPON

1. Advance Registration Fee (the extra quarter covers part of the first class postage) enclosed: (check one)
   ☐ **$2.25 AAAS Member** ☐ **$2.25 College Student**
   ☐ **$2.25 Wife (or Husband) of Registrant** ☐ **$3.25 Nonmember of AAAS**
2. FULL NAME (Dr., Miss, etc.) ..... (Please print or typewrite) (Last) (First) (Initial)
3. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION .....
4. OFFICE OR HOME ADDRESS ..... (For receipt of Program and Badge)
5. YOUR FIELD OF INTEREST .....
6. CONVENTION ADDRESS ..... (If not known now may be added later)
7. DATE OF ARRIVAL ..... DATE OF DEPARTURE .....

Please mail this Coupon and your check or money order for the fee, $2.25 or $3.25, to
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
1515 Massachusetts Avenue, N.W., Washington 5, D. C.

HOTEL RESERVATIONS

118th AAAS MEETING

Philadelphia, December 26-31, 1951

The list of hotels and the reservation coupon below are for your convenience in making your hotel room reservation in Philadelphia. Please send your application, *not* to any hotel directly, but to the AAAS Housing Bureau in Philadelphia and thereby avoid delay and confusion. The experienced Housing Bureau will make assignments promptly; a confirmation will be sent you in two weeks or less. **Share a room with a colleague if you wish to keep down expenses.** Mail your application *now* to secure your first choice of desired accommodations.

HOTELS AND RATES PER DAY

Hotel★	Single	Double	Twin-Bedded	Suites
ADELPHIA★	$5.00–$6.00	$7.50–$10.50	$10.00–$12.50	$25.00–$35.00
BARCLAY			$ 8.00–$12.00	$14.00–$25.00
BELLEVUE–STRATFORD★	$4.50–$6.00	$8.00–$10.00	$ 9.00–$12.00	$20.00–$30.00
BENJAMIN FRANKLIN★	$5.00–$7.50	$8.00–$10.50	$11.00–$13.00	$18.00
DRAKE	$6.00	$ 7.00	$ 9.00	$15.00
ESSEX	$4.75–$5.00	$6.00–$ 8.50	$ 9.00–$10.00	
JOHN BARTRAM★	$3.25–$4.50	$5.00–$ 8.00	$ 7.00–$ 9.00	
PENN SHERATON	$5.00–$7.50	$7.50–$10.00	$ 8.00–$10.50	$12.00–$15.00
RITZ–CARLTON★	$7.00–$7.50		$11.00–$12.00	
ROBERT MORRIS	$4.50–$5.00	$7.00–$ 8.00	$ 8.00	
ST. JAMES	$4.00–$5.50	$6.00–$ 8.00	$ 6.50–$ 9.00	
SYLVANIA★			$ 9.00–$11.00	$18.00
WARWICK			$ 9.00–$12.00	$22.00–$24.00

Cots added to a room are $2.50 each; dormitory style rooms (for 5 or more) are $3.50 per person.

★ **Hotels starred have sessions in their public rooms.** For a list of the headquarters of each participating society and section, please see Association Affairs, *Science*, August 24, or *The Scientific Monthly*, September.

THIS IS YOUR HOTEL RESERVATION COUPON

AAAS Housing Bureau
Architects Building (1st Floor)
Philadelphia 3, Pa.

Date of Application .....

Please reserve the following accommodations for the 118th Meeting of the AAAS:

TYPE OF ACCOMMODATION DESIRED

...Single Room(s) Desired Rate ..... Maximum Rate .....

...Double Room(s) Desired Rate ..... Maximum Rate ..... Number in Party .....

...Twin-Bedded Room(s) Desired Rate ..... Maximum Rate .....

...Suite(s) Desired Rate ..... Maximum Rate ..... Sharing this room will be:

.....(*Enumerate persons here and attach list giving name and address of each person, including yourself*)

CHOICE OF HOTEL

First Choice ..... Second Choice ..... Third Choice .....

DATE OF ARRIVAL ..... DEPARTURE DATE .....
(These must be indicated)

NAME .....
(Please print or type)

ADDRESS .....
(Street) (City and Zone) (State)

Mail this now to the Housing Bureau. **Rooms will be assigned and confirmed in order of receipt of reservation.**

NUCLEOPROTEINS

and

DERIVATIVES

Adenosine Triphosphate	Hypoxanthine
Adenine	Inosine
Adenine Sulfate	Iron Nucleate
Adenylic Acid	Manganese Nucleate
Adenosine	6 Methyl Uracil
Cozymase	Nucleic Acid (Ribose Nucleic Acid)
Cytidine	Protamine Nucleate
Cytidine Sulfate	Phosphoglyceric Acid
Cytidylic Acid	d Ribose
Cytosine	Sodium Nucleate
Desoxyribonucleic Acid	Sodium Desoxyribonucleate
Fructose-6-Phosphate (Barium)	Ammonium Uridylate
Glucose-1-Phosphate (Potassium)	Thymine (5 Methyl Uracil)
Glutathione	Uracil
Guanine	Uridine
Guanine Hydrochloride	Uridylic Acid
Guanosine	Uramil
Guanylic Acid	Xanthine
Hexase Diphosphate	Xanthosine

Write for Revised Catalogue S#901 Listing a Complete Selection of Nearly 500 Important Biochemicals

NUTRITIONAL BIOCHEMICALS CORP.

21010 Miles Avenue • Cleveland 28, Ohio

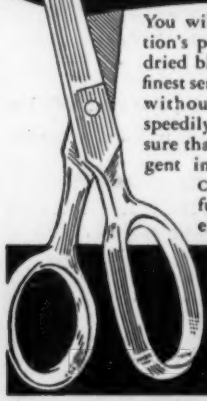
FREE!

CUT OUT THIS AD AND PIN IT TO YOUR LETTERHEAD FOR ENOUGH

COAGUSOL

T. M. REG. U. S. PAT. OFF.

TO MAKE 6 GALLONS OF SOLUTION!



You will find that a COAGUSOL solution's penetrating action strips stains, dried blood and tissue from even the finest serration of surgical instruments, without soap, without scrubbing—speedily, economically. Because we are sure that you will find this new detergent invaluable—we ask you to try COAGUSOL at our expense. For full information and your generous sample, write right now to

HOSPITAL LIQUIDS
Incorporated

2900 S. Michigan Avenue
Chicago 16, Ill.

Laboratories at Chicago, U. S. A.

Publications Received

The Principles of Heredity. 4th ed. Laurence H. Snyder. Boston: Heath, 1951. 515 pp. $4.75.

Introduction to Servomechanisms. A. Porter. London: Methuen; New York: Wiley, 1950. 154 pp. $1.75.

Borderlands of Science. Alfred Still. New York: Philosophical Library, 1950. 424 pp. $3.75.

Semimicro Qualitative Analysis. Rev. ed. William Lloyd Evans, Alfred Benjamin Garrett, and Harry Hall Sisler. Boston, Mass: Ginn, 1951. 240 pp. $3.00.

Water Treatment for Industrial and Other Uses. Eskel Nordell. New York: Reinhold, 1951. 526 pp. $10.00.

Social Choice and Individual Values. Kenneth J. Arrow. New York: Wiley; London: Chapman & Hall, 1951. 99 pp. $2.50.

The Differentiation of* Escherichia *and* Klebsiella *Types. F. Kauffmann. Springfield, Ill.: Thomas, 1951. 57 pp. $2.00.

Brief College Chemistry. Rev. ed. Leon B. Richardson and Andrew J. Scarlett. New York: Holt, 1951. 470 pp. $4.25.

A Second Course of Mechanics and Properties of Matter. A. E. E. McKenzie. New York: Cambridge Univ. Press, 1950. 232 pp. $2.50.

Principles and Practice of Bacteriology. 4th ed. Arthur H. Bryan and Charles G. Bryan. New York: Barnes & Noble, 1951. 410 pp. $1.75.

Progress in Chromatography 1938–1947. L. Zechmeister. New York: Wiley, 1950. 368 pp. $8.00.

Jacobian Elliptic Function Tables. L. M. Milne-Thomson. New York: Dover, 1950. 123 pp. $2.45.

Personnel Administration in Public Health Nursing. William Brody. St. Louis, Mo.: Mosby, 1951. 209 pp. $3.25.

An Introduction to Psychology. Gardner Murphy, with assistance of Herbert Spohn. New York: Harper, 1951. 583 pp. $4.25.

Safety in the Chemical Laboratory. H. A. J. Pieters with the collaboration of J. W. Creyghton. New York: Academic Press; London: Butterworths Scientific Pubs., 1951. 258 pp. $3.50.

Essays on Logic and Language. Antony Flew, Ed. New York: Philosophical Library, 1951. 206 pp. $3.75.

Genesis and Geology: A Study in the Relations of Scientific Thought, Natural Theology, and Social Opinion in Great Britain, 1790–1850. Charles Coulston Gillispie. Cambridge, Mass.: Harvard Univ. Press, 1951. 315 pp. $4.50.

Man Is a Microcosm. J. A. V. Butler. New York: Macmillan, 1951. 162 pp. $3.00.

Methods of Vitamin Assay. Rev. 2nd ed. Prepared and edited by the Association of Vitamin Chemists, Inc. New York: Interscience, 1951. 301 pp. $5.50.

Marine Products of Commerce: Their Acquisition, Handling, Biological Aspects and the Science and Technology of Their Preparation and Preservation. 2nd ed. Donald K. Tressler and James McW. Lemon. New York: Reinhold, 1951. 782 pp. $18.00.

Your Health. Dean Franklin Smiley and Adrian Gordon Gould. New York: Macmillan, 1951. 555 pp. $4.50.

A History of Nursing. 2nd ed. Gladys Sellew and C. J. Nuesse. St. Louis, Mo.: Mosby, 1951. 439 pp. $3.75.

Dimensional Analysis and Theory of Models. Henry L. Langhaar. New York: Wiley; London: Chapman & Hall, 1951. 166 pp. $4.00.

the Berkeley
MICROTOME KNIFE SHARPENER
assures an
INCOMPARABLE EDGE
3 times faster...

COMPARE THE EDGES. Photomicrograph *(a)* shows a microtome knife edge sharpened by the Berkeley sharpener. Note its even smoothness, assurance of better sections. Photomicrograph *(b)* shows a blade laboriously hand sharpened, honed and stropped, but note the nicks and serrations still remaining.

COMPARE THE TIME. In tests, wherever made, and in practice in hundreds of laboratories, the Berkeley Microtome Knife Sharpener gives perfect edges in one-third the time required for hand honing and stropping.

Let us send you Bulletin MKS-12 giving full information about this indispensable laboratory aid.

Berkeley Scientific Corporation
2200 WRIGHT AVE. • RICHMOND, CALIF.

The most complete book on the subject

Weed Seedlings

By Anna P. Kummer

In this book growers and students of plants have available for the first time a tool by which they may identify any weed seedlings apt to be found growing in gardens, woods, farms, and ranches, or experimental plots. It makes possible the determination of three hundred broad-leaved weed seedlings by comparing them with representative and detailed drawings of *natural size* or by using the key provided. $5.00

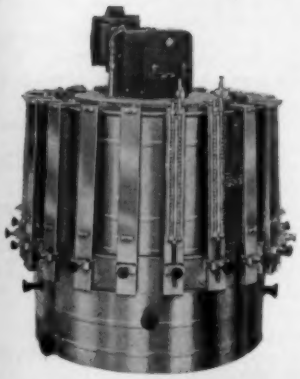
THE UNIVERSITY OF CHICAGO PRESS
5750 Ellis Avenue, Chicago 37, Illinois

BARCROFT-WARBURG APPARATUS

Immediate Delivery!

20-Unit CIRCULAR Type
Room temperature to 60°c.

The "PRECISION" CIRCULAR BARCROFT-WARBURG APPARATUS represents the finest in modern research apparatus. Also available for immediate delivery are Reaction vessels, Manometers, Calibrators, & Accessories.

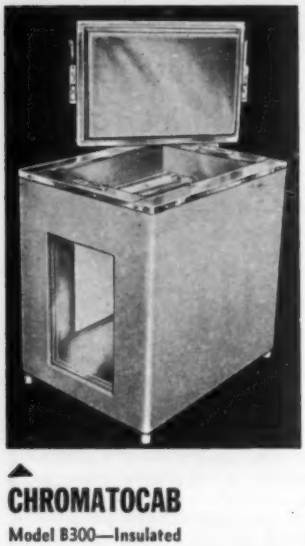


We maintain a modern glassblowing department for special scientific and technical glass apparatus made to specifications and drawings. We invite your inquiries and will gladly furnish estimates upon request.

Write for Bulletin 675.

MACHLETT
Laboratory APPARATUS • SUPPLIES • CHEMICALS
E. MACHLETT & SON
ESTABLISHED 1907
220 EAST 23rd STREET • NEW YORK 10, N.Y.

SPECIALISTS IN WARBURG EQUIPMENT SINCE 1928



Paper Partition

CHROMATOGRAPHY

Equipment

Cabinets
Cylinders & Racks
Miscellaneous
Accessory Equipment
Specially
Designed for
Paper Partition
Chromatographic
Analysis

Write for Descriptive Brochure

CHROMATOCAB

Model B300—Insulated

BERKELEY CHROMATOGRAPHY DIV.

University Apparatus Company

Dept. H • 2229 McGee Avenue • Berkeley 3, Calif.

PLANT AND ANIMAL BIOCHEMISTRY

by E. T. MERTZ and J. W. PORTER, Purdue University

This book gives equal emphasis to plant and animal biochemistry and provides a background for future work in any branch of the biological sciences.

Following each discussion of organic chemistry or biochemistry is an account of their biosynthesis, metabolism and industrial uses.

Plant and animal biochemistry will serve equally well in undergraduate courses offered to students majoring in agriculture, biology, chemistry, home economics and premedicine.

PRICE $3.25

Send for an On-Approval Copy

BURGESS PUBLISHING COMPANY

428 SOUTH SIXTH STREET • MINNEAPOLIS 15, MINNESOTA

Meetings & Conferences

Sept. 29–Oct. 5. American Welding Society. Detroit, Mich.

Oct. 1–3. Association of Official Agricultural Chemists. Shoreham Hotel, Washington, D. C.

Oct. 3–4. Association of American Feed Control Officials. Shoreham Hotel, Washington, D. C.

Oct. 3–5. American Institute of Mining and Metallurgical Engineers (Annual). Oklahoma Biltmore, Oklahoma City.

Oct. 4–6. American Physical Society, Division of Electron Physics. Conference on Gaseous Electronics, G-E Research Laboratory, Schenectady, N. Y.

Oct. 5. American Crystallographic Association, Michigan chapter. University of Michigan, Ann Arbor.

Oct. 5. Association of American Fertilizer Control Officials. Shoreham Hotel, Washington, D. C.

Oct. 5. National Noise Abatement Symposium (Annual). Technology Center, Chicago.

Oct. 6. Association of Economic Poison Control Officials. Shoreham Hotel, Washington, D. C.

Oct. 8–10. The American Oil Chemists' Society (Fall). Edgewater Beach Hotel, Chicago.

Oct. 9–11. American Meteorological Society. Minneapolis.

Oct. 10–12. Porcelain Enamel Institute. Ohio State University, Columbus.

Oct. 15–17. American Gas Association (Annual). Kiel Auditorium, St. Louis.

Oct. 15–18. American Dental Association (Annual). Washington, D. C.

Oct. 15–19. National Metal Congress and Exposition. Detroit, Mich.

Oct. 15–19. Society of Motion Picture and Television Engineers (Fall). Hollywood Roosevelt Hotel, Hollywood, Calif.

Oct. 15–19. World Metallurgical Congress (Annual). Detroit, Mich.

Oct. 18–20. American Chemical Society and Southern Association of Science and Industry, Southwide Chemical Conference. Wilson Dam, Ala.

Oct. 18–20. National Association of Corrosion Engineers (Regional). Corpus Christi, Tex.

Oct. 20–21. Way of Science Conference (Annual). Roosevelt College, Chicago.

Oct. 20–26. First Pan American Congress on Veterinary Medicine. Lima, Peru.

Oct. 22–23. Independent Petroleum Association of America (Annual). The Shamrock, Houston, Tex.

Oct. 22–24. American Association of Blood Banks (Annual). Hotel Nicollet, Minneapolis.

Oct. 22–24. American Standards Association (Annual). Waldorf-Astoria, New York.

Oct. 22–24. National Electronics Conference and Exhibition. Edgewater Beach Hotel, Chicago.

Oct. 22–25. American Academy of Pediatrics (Annual). Royal York Hotel, Toronto.

Oct. 22–26. American Institute of Electrical Engineers (Fall). Hotel Cleveland, Cleveland.

Oct. 23–24. Optical Society of America (Annual). Hotel Sherman, Chicago.

Oct. 24–27. American Physical Society. Chicago.

Oct. 29–Nov. 2. American Public Health Association. Civic Auditorium, San Francisco.

Nov. 1–3. American Physical Society, Division of Electron Physics. National Bureau of Standards, Washington.

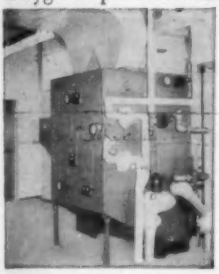
Drying Problem Solved by New Method

•

New, Niagara "Controlled Humidity" Method provides air at precise conditions of temperature and humidity and permits accurate variations of such conditions at will, in the range of 34°F. to 140°F.; also below 32°. if required.

This Method uses "Hygrol" liquid absorbent to remove moisture from the air directly, saving the cost of refrigeration for dehumidification. Operation is completely and reliably automatic; the absorbent is re-concentrated as fast as it is used.

It is used successfully in drying processes, control of hygroscopic materials, preventing moisture damage to materials or instruments, providing controlled atmosphere for tests and experiments. Units provide capacity ranges from 1000 c. f. m. to 20,000 c. f. m.



Write for Bulletin No. 112; address Niagara Blower Co., Dept. SW, 405 Lexington Avenue, New York 17, N.Y.

PHOTOVOLT

Line-Operated Electronic MULTIPLIER-PHOTOMETER

Mod. 520-M

For the exact measurement of extremely low light values down to 1/10,000 microlumen.

Write for Bulletin #360 to

PHOTOVOLT CORP.

95 Madison Ave. New York 16, N. Y.

KLETT ELECTROPHORESIS

CUSTOM MADE

TOOL FOR THE ANALYSIS OF COMPLEX COLLOID SYSTEMS, AND FOR THE CONTROL OF PRODUCTION OF PURIFIED PROTEINS, ENZYMES, HORMONES

KLETT MANUFACTURING CO.
179 EAST 87TH STREET
NEW YORK, N. Y.

PERSONNEL PLACEMENT

YOUR ad here reaches over 32,000 foremost scientists in the leading educational institutions, industrial laboratories, and research foundations in the U. S. and 76 foreign countries—at a very low cost

CLASSIFIED: 15¢ per word, minimum charge $3.00 Use of Box Number counts as 10 additional words.

DISPLAY: $17.50 per inch, no charge for Box Number.

Correct payment to SCIENCE must accompany all ads. Insertion usually made 2 or 3 weeks after receipt of ad.

SCIENCE • 1515 Mass. Ave., N.W., Wash. 5, D. C.

POSITIONS WANTED

Experienced Technical Editor, article writer, public relations speaker, in fields of Electronics, Physics, Photography, Fire Safety, etc., seeks position on policy-making level. A planner, a producer. Salary requirement $15.000. Box 580, SCIENCE. X

Positions Wanted:
(a) **Physician** with scientific background (Physiological Chemistry); several years' teaching experience (Bacteriology); seven years, Assistant Director, clinical research, research institution. (b) **Ph.D.** (Chemistry); nine years, director of chemical research, large industrial company. For further information, please write Science Division, Medical Bureau (Burneice Larson, Director), Palmolive Building, Chicago. X

POSITIONS OPEN

Positions Open:
(a) **Physician** qualified in infectious diseases or nutrition; important research appointment, one of leading pharmaceutical companies. (b) **Radiation Biologist;** Doctor's degree preferred, Master's degree eligible; should have knowledge of production, physics, biological effects of alpha particles; West; $5000. (c) **Ph.D.** primarily trained in physical chemistry and thermodynamics; advantageous if oriented in direction of biophysics; medical school research appointment; Midwest. (d) **Biochemist,** Ph.D., to supervise clinical laboratories and develop more difficult diagnostic procedures; university medical school; South; minimum $6000; percentage later. (e) **Bacteriologist,** Ph.D., trained in virology and, also, biochemist well grounded in intermediary metabolism, enzymes, hormone and cancer research; one of major companies; straight research. (f) **Histopathologist;** preferably experienced in research or tumor pathology; research post; agricultural college; South; $8000. S9-3 Science Division, Medical Bureau (Burneice Larson, Director), Palmolive Building, Chicago. X

SCIENTISTS—salaried positions, $3,600 to $25,000. This confidential service for outstanding men who desire a change of connection, will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. **TOMSETT ASSOCIATES** • 1205 Berger Bldg., Pittsburgh 19, Pa.

YOU can TELL and SELL over 32,000 top scientists here . . . at a very low cost.

Your sales message in an ad this size costs only $43.75 at the one-time rate—less for multiple insertions. And the results!—well, here's what one of the many satisfied advertisers in SCIENCE has to say . . .

"SCIENCE is consistently our most profitable medium. Business secured solely thru SCIENCE ads has been the backbone of our success in this field."

"We carry a considerable amount of advertising in various periodicals, but none is so productive of results as SCIENCE."

Prove to yourself the effectiveness of SCIENCE in increasing your Market, Sales, and PROFITS—send your "Copy" NOW —or write for further information and Rate card No. 27B.

SCIENCE *weekly reaches over 32,000 top scientists* 1515 Mass. Ave., N.W., Wash. 5, D. C.

POSITIONS OPEN

Biochemist, M.S. or experienced B.S. to assist in drug metabolism research. Pharmacology Dept., Abbott Laboratories, North Chicago, Illinois. 9/28

Biochemist: Excellent opportunity for recent Ph.D. in research laboratory for midwest pharmaceutical manufacturer. Box 12, SCIENCE. X

Clinical Contact Man—Basic knowledge of medicine. Capacity to write clinical papers. Adequate clinical contact essential. Salary commensurate with background and training to direct clinical research activities of drug house located in Phila. Reply fully to L-79, P.O. Box 3495, Phila. 22, Pa. X

Field Representative: Nationally known publisher needs a college graduate with a major in the biological sciences to call on medical and nursing educators. Please send complete details including salary. Box S 1344, Equity 221 W. 41 St., N. Y. 18. X

Pharmacologist, Ph.D. with experience; opportunity with prominent and progressive central New Jersey pharmaceutical concern; also Asst. Pharmacologist with B.S. or equivalent qualifications. Write full details and salary interests to Box 11, SCIENCE. 9/21

Entries in the **Fifth International Photography-in-Science Salon,** sponsored annually by THE SCIENTIFIC MONTHLY and the Smithsonian Institution, should be sent (prepaid) to the Editor, *The Scientific Monthly,* 1515 Massachusetts Ave., N.W., Washington 5, D. C., Nov. 1–Nov. 27. All accepted photographs will be shown at the AAAS meeting in Philadelphia Dec. 26–31, and later throughout the U. S. For entry blanks and full information write to the address given above.

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

YOUR ad here reaches over 32,000 foremost scientists in the leading educational institutions, industrial laboratories, and research foundations in the U. S. and 76 foreign countries—at a very low cost

CLASSIFIED: 20¢ per word, minimum charge $5.00. Use of Box Number counts as 10 additional words. Correct payment to SCIENCE must accompany ad.

DISPLAY: Rates listed below—no charge for Box Number. Monthly invoices will be sent on a charge account basis —providing satisfactory credit is established.

Single insertion	**$17.50 per inch**
7 times in 1 year	**16.00 per inch**
13 times in 1 year	**14.00 per inch**
26 times in 1 year	**12.50 per inch**
52 times in 1 year	**11.00 per inch**

For PROOFS on display ads, copy must reach SCIENCE 4 weeks before date of issue (Friday of every week).

BOOKS

BACK NUMBER PERIODICALS — Bought and Sold
• Tell us what you want!—What have you to offer?
Abrahams Magazine Service Established 1889 ▶ DEPT. P, 56 E. 13th ST. NEW YORK 3, N. Y.

WANTED TO PURCHASE . . . **SCIENTIFIC PERIODICALS and BOOKS** Sets and runs, foreign and domestic. Entire libraries and smaller collections wanted.
WALTER J. JOHNSON • 125 East 23rd St., New York 10, N. Y.

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

YOUR ad here reaches over 32,000 foremost scientists in the leading educational institutions, industrial laboratories, and research foundations in the U. S. and 76 foreign countries—at a very low cost

CLASSIFIED: 20¢ per word, minimum charge $5.00. Use of Box Number counts as 10 additional words. Correct payment to SCIENCE must accompany ad.

DISPLAY: Rates listed below—no charge for Box Number. Monthly invoices will be sent on a charge account basis —providing satisfactory credit is established.

Single insertion	**$17.50 per inch**
7 times in 1 year	**16.00 per inch**
13 times in 1 year	**14.00 per inch**
26 times in 1 year	**12.50 per inch**
52 times in 1 year	**11.00 per inch**

For PROOFS on display ads, copy must reach SCIENCE 4 weeks before date of issue (Friday of every week).

BOOKS

Your sets and files of scientific journals

are needed by our library and institutional customers. Please send us lists and description of periodical files you are willing to sell at high market prices. Write Dept. A3S, J. S. CANNER, INC. Boston 19, Massachusetts

SCIENTIFIC BOOKS and PERIODICALS WANTED

Complete libraries—Sets and runs—Single titles
Also, please send us your want lists.

STECHERT-HAFNER, INC.
31 East 10th St., New York 3

OCT. 5 **Equipment Issue**

- Both the editorial and advertising pages of this special issue will feature an unusually interesting and comprehensive review of the latest developments in scientific instruments and equipment. It will be of direct interest to the more than 33,000 readers of SCIENCE.
- Send your advertising copy now. Regular rates apply.

SUPPLIES AND EQUIPMENT

FREE CATALOG No. 677..

Lists more than 300 items for Research— Biological, Microbiological, Bacteriological, Biochemical, Nutritional. Write

GBI 72 LABORATORY PARK
CHAGRIN FALLS, OHIO

L-PROLINE—Hydroxyproline, L-Methionine
• AMINO ACIDS • BIOCHEMICALS
• PRE-MIXED MICROBIOLOGICAL ASSAY MEDIA
H. M. CHEMICAL COMPANY, LTD.
144 North Hayworth Avenue Los Angeles 48, California

Science writers are invited to write or wire to Westinghouse Awards, 1515 Massachusetts Ave., N.W., Washington 5, D. C., for details of the annual $1,000 AAAS-George Westinghouse Science Writing Awards for both newspaper and magazine writers. Nominations for the awards are also invited. Deadline for receipt of entries, which must be made in triplicate, is *Oct. 8.*

SUPPLIES AND EQUIPMENT

STAINS
STARKMAN Biological Laboratory
• RARE
• COMMON
Price list on Request
• 461 Bloor St., W. Toronto, Canada

—PLANT NUTRIENT TABLETS—

. . . for Plant Culture

Each tablet contains one gram of a nutrient. Saves the time of weighing out each ingredient for each experiment.

For experiment stations, hydroponics, high school and college classes in botany etc.

Write for leaflet PN-S

CARGILLE SCIENTIFIC INC., 118 Liberty St., New York, N. Y.

ANIMAL CAGES AND ACCESSORY EQUIPMENT

BUY DIRECT FROM MANUFACTURER
HOELTGE BROS., Inc.
1919 Gest St. **Cincinnati 4, Ohio**
Write for Illustrated Catalog

3 NEW MICROSCOPE ILLUMINATORS by LINDLY
foremost in MICROSCOPE LAMPS

Brilliant, adjustable, variable intensity illumination *all-purpose* lamps for laboratory, research and industry.

LINDLY & CO. 80 HERRICKS RD. MINEOLA, N. Y.

SPRAGUE-DAWLEY, INC.

Pioneers in development of the standard laboratory rat

Box 2071 • Madison 5, Wisconsin • Phone 36134

White SWISS Mice 20c and up

Rabbits, Cavies, White Rats, Ducks, Pigeons, Hamsters
Write • J. E. STOCKER • Ramsey, N. J.

For CONSISTENT Rats . . .

• BUDD MT. RODENT FARM

• CHESTER, N. J.

Breeders of a recognized strain of Wistar.

LOOK AROUND... notice the increasing number of satisfied advertisers using small-space ads regularly in practically every issue of SCIENCE—*proof that these small ads get results!* If you have a product or service of interest to scientists, why not take advantage of this low-cost means of increasing your profits!

The MARKET PLACE

BOOKS • SERVICES • SUPPLIES • EQUIPMENT

YOUR ad here reaches over 32,000 foremost scientists in the leading educational institutions, industrial laboratories, and research foundations in the U. S. and 76 foreign countries—at a very low cost

CLASSIFIED: 20¢ per word, minimum charge $5.00. Use of Box Number counts as 10 additional words. Correct payment to SCIENCE must accompany ad.

DISPLAY: Rates listed below—no charge for Box Number. Monthly invoices will be sent on a charge account basis —providing satisfactory credit is established.

Single insertion	$17.50 per inch
7 times in 1 year	16.00 per inch
13 times in 1 year	14.00 per inch
26 times in 1 year	12.50 per inch
52 times in 1 year	11.00 per inch

For PROOFS on display ads, copy must reach SCIENCE 4 weeks before date of issue (Friday of every week).

SUPPLIES AND EQUIPMENT

PARASITOLOGICAL PREPARATIONS

• high quality — low priced. *Write for catalog*

TROPICAL BIOLOGICALS • P.O. Box 2227, San Juan, Puerto Rico.

All Amino Acids (natural, synthetic, unnatural). Rare Sugars, Biochemical Products, Reagents. New Pharmaceuticals in stock. Write or phone PLaza 7-8171 for complete price list.

BIOS LABORATORIES, INC. 17 West 60th Street. New York 23. N. Y.

SUPPLIES AND EQUIPMENT

LABORATORY ANIMALS

DOGS CATS MICE RATS PIGEONS POULTRY RABBITS HAMSTERS GUINEA PIGS

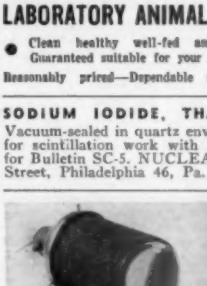
• Clean healthy well-fed animals. Guaranteed suitable for your needs.

Reasonably priced—Dependable service

JOHN C. LANDIS • Hagerstown, Md.

SODIUM IODIDE, THALLIUM-ACTIVATED CRYSTALS

Vacuum-sealed in quartz envelopes to insure permanency. Designed for scintillation work with standard photomultiplier tubes. Write for Bulletin SC-5. NUCLEAR RESEARCH CORP. 2707 Federal Street, Philadelphia 46, Pa.



new HEINICKE micro illuminator

Designed by Dr. Kurt J. Heinicke, for the inclined binocular microscope—superb at all magnification levels. 3" clear, aspheric condensing system. Equal or bettter than $60.00 illuminators. **Price $9.50.** Please order directly or write for details.

HEINICKE Instrument Corporation

• P. O. BOX 2872 HOLLYWOOD, FLORIDA

THE RICKETTSIAL DISEASES OF MAN

This symposium volume is a comprehensive survey of the general field of Rickettsial diseases in man. Among the contributors appear the names of many of the foremost American authorities on this important and relatively new field of medicine.

The first group of papers includes discussions of the taxonomy, biology, isolation, and identification of vectors, and reservoirs of infection of the Rickettsial diseases of man. The second group of papers is devoted to discussions of serological reactions, the Weil-Felix reaction, the complement-fixation and agglutination reactions, and the preparation and standardization of Rickettsial vaccines. The final group of papers treats of insecticides, methods of their application, and mite controls.

Many of the 27 contributors to this volume during World War II were on the battle fronts in Africa, Italy, France and Germany, protecting our troops and the local populations wherever Rickettsial diseases prevailed. Rarely, if ever, have the authors of a medical book had so wide and so successful practical experience in the very subjects on which they have written.

ORDER YOUR COPY *NOW*

To: A.A.A.S. Publications
1515 Massachusetts Avenue, N.W., Washington 5, D. C.

Please accept my order for one copy of *The Rickettsial Diseases of Man* (7¼ × 10¼, cloth bound). My check in correct payment is enclosed ($5.25 to A.A.A.S. members, $6.25 to those who are not members; including postage.)

Name .....

Address .....

City ..... Zone ..... State .....

What GENERAL ELECTRIC People Are Saying

F. C. KRINGS

Apparatus Department

MICROWAVE FOR UTILITIES: Recently there has been a vast interest shown in microwave as a form of communication for the electric utilities. This interest arises from the availability of microwave frequencies and microwave equipment for use in operating and dispatching channels. It is important, therefore, that this new method should be properly evaluated.

Frequency bands in the range between 950 and 30,000 megacycles are among the space radio-frequency bands assigned by the Federal Communications Commission for utility-company use. These frequencies are among those called microwave and require a line of sight from one antenna to the other with approximately a 50-foot clearance above intervening objects.

One of the attractions of a microwave channel is the band width that is available. This wide band width permits the simultaneous transmission of several voice and control channels. . . .

The objectives of a utility's dispatching and operating communication are these: To achieve reliable telephone service for its dispatching; dependable supervisory control over its unattended substation; accurate and dependable telemetering and load control of the power flow over its tie lines; and the high-speed selective relaying obtainable by using a pilot form of relaying.

The reliability of these services is of great importance, and they should be operable under all weather conditions. Terminal equipment and power supplies for the equipment should be immune to failure, and maintenance requirements should be such as to require only short outage time on a planned basis.

Because microwave and carrier are both capable of supplying the channels for the operating and dispatching communication needs of an electric utility company, the choice is largely determined by economics and reliability. In many cases, the reliability requirement will become the predominant factor. . . .

Microwave tends to be suitable for a large number of channels between terminal points; in other words, multichannel installations. . . . Carrier tends to be more suitable for party-line channels to scattered points. . . . Not only is there a definite place for microwave and a definite place for carrier, but also they can supplement each other.

General Electric Review

July, 1951

★

J. H. CAMPBELL

H. E. SCHULTZ

Lamp Department

OLD LAMPS VS. TELEVISION: It has been known for some time that vacuum-type filament lamps with a straight-draped wire filament could produce radiation at television frequencies. In fact, tests were conducted in Bridgeport and Schenectady as early as 1940 on various types of filament lamps furnished for the purpose by the General Electric Company's Lamp Department. These tests revealed that only the S-1 type of filament in vacuum caused sustained oscillations that could be picked up by the television antenna or the unshielded parts of the receiver.

Lamps of this type for home lighting were not manufactured after 1925, so the problem is not generally considered a serious one as compared with other sources of interference. However, since there are now over 12,000,000 television sets in operation, it is understandable that many older homes contain one or more of the veteran lamps as well as a television receiver.

The radiation can be reflected away or dissipated by applying various types of metal reflectors, but no one recommendation will apply to all installations. The best and least expensive cure is to replace these veterans of 25 to 40 years with a modern lamp, which produces light at much higher efficiency and costs about one-third as much to buy as the old ones did. On an equal light-output basis, one of the modern 60-watt lamps is equivalent to 3¼ of the old 25-watt lamps.

General Electric Review

July, 1951

You can put your confidence in

GENERAL ELECTRIC

an AO MICROSCOPE

Completes the Laboratory Picture

Whatever the requirements of your laboratory, you'll find the *right microscope* in the extensive AO Spencer Line. Besides the various types shown at left there are numerous special purpose instruments, illuminators, stages, measuring and counting discs, and other accessories. Throughout the line you'll find consistently high quality optics and long-lasting smoothness in mechanical movements. Many models provide such modern features as "auto-focus", "adjustable tension", and "built-in illumination".

Every AO Spencer instrument is backed by 100 years of precision instrument manufacture—your assurance of lasting satisfaction and service that's *always* available. Write for literature today.

Dept. W3

AO BINOCULAR MICROSCOPES—provide natural 8° convergence and exceptional eye comfort for extended observations.

AO MONOCULAR MICROSCOPES—laboratory "work horses" for counting, identifying, studying the effects of processing and many other duties.

AO POLARIZING MICROSCOPES—for the identification and analysis of crystalline materials, both natural and man made.

AO RESEARCH MICROSCOPES—utmost versatility and convenience for studies that require the ultimate in optical and mechanical performance.

AO PHASE MICROSCOPES—essential for examining highly transparent living organisms, emulsions, and other materials.

AO STEREOSCOPIC MICROSCOPES—the industrial "trouble shooter", provides vivid, erect three-dimensional images with magnification that simplifies identification, counting and quality control.

American Optical COMPANY

INSTRUMENT DIVISION • BUFFALO 15, NEW YORK